

2004

WISCONSIN'S STATEWIDE FOREST PLAN

ENSURING A **SUSTAINABLE** FUTURE



On-Line Assessment, Plan, and Actions www.dnr.wi.gov/org/land/forestry/look/assessment/

Wisconsin's Statewide Forest Plan Ensuring a Sustainable Future

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Wisconsin Department of Natural Resources – Division of Forestry wishes to acknowledge officials and staff from numerous town, county and state agencies, universities, organizations, businesses, and over 2,000 Wisconsin residents who have participated in this planning process.

Our forests are treasures of infinite value. As such, we all need to steward them to ensure they continue to provide the full array of ecological, economic, and social benefits for generations to come.

The plan you are about to examine is the result of over four years of forest assessment and planning. The plan identifies over 50 issues facing forests and forestry in Wisconsin and provides a framework to address those issues. I commend the public for the desire throughout the planning process to keep the list of issues addressed by the plan as inclusive as possible. Understandably, this breadth of issues has created a significant challenge for everyone involved in the planning process. Despite our best efforts to concisely describe the large number of complex and often controversial issues, we understand the amount of material is substantial.

In order to keep the plan manageable and easy to use, we have tried to keep discussion of the trends and issues brief. In addition, we have developed a web-based system to provide easy navigation and continuous updating as information becomes available.
www.dnr.wi.gov/org/land/forestry/look/assessment/

The November 2004 Governor's Conference on Forestry marks the initial step in an on-going process to refine and develop an implementation plan for the issues identified herein. Our long-term success depends on our collective ability to actively engage in steps to tackle the challenges described. I am confident in our ability to work together to make strides that will ensure a sustainable future for the forests of Wisconsin and the millions of people who both value and rely on them.

I greatly appreciate your interest and passion for forestry in Wisconsin and your willingness to work collaboratively to shape the future of Wisconsin's magnificent forest resources. Our challenge is not a small one, however, the rewards of our efforts will be reaped for generations to come.



Paul DeLong
Chief State Forester



**Wisconsin's Statewide Forest Plan:
Ensuring a Sustainable Future**

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INTRODUCTION

Wisconsin's forests cover 16 million acres, or 46% of the state's land area. While the public sector and the forest industry own significant forest acreage, most of the state's forestland (57%), is owned by private non-industrial landowners. Thirty percent of the state's forests are owned by the public sector, with federal holdings accounting for 10%, state holdings 5%, and county governments, municipalities, and school districts totaling 15%. Accounting for the balance of the forest resource, Wisconsin's tribes own 2% of the state's forests, corporations own 4%, and the forest industry owns 7%.



Wisconsin's forests are important to many people because they have the unique ability to meet many different needs at once. The production and use of forest products provide products we all use daily, as well as generates employment and support the economic well being of rural and urban communities alike. Public and private forestlands provide opportunities for recreation such as hiking and hunting, as well as the opportunity to simply sit and enjoy the quiet beauty of a forest. Furthermore, our forests clean our air and water, provide habitat for a wide range of plant and animal species, and provide a setting in which we live, work and play.

Virtually all outdoor pursuits—from birdwatching to snowmobiling—have increased in popularity in the last decade. Forest recreation inputs millions of dollars into Wisconsin's economy every day. While the increasing interest in outdoor activities and recreating in forests is a positive turn of events, it brings with it a complex set of new forest management challenges. Continuing growth in the popularity of trail-based activities, for example, has heightened tension between user groups, particularly between motorized and non-motorized recreationists. Many visitors also find harvested timber units unsightly, and negative attitudes toward the immediate effects of timber harvesting in some cases can make active forest management difficult to undertake. An increased commitment to outreach, community dialogue, and planning will be needed to inform the public about the importance of sustainable forest management, involve the public in decision-making, and manage conflicts between user groups.

The enduring productivity of Wisconsin's forests has long been essential to the stability and growth of our state's economy. The forest products sector composes approximately 6% of Wisconsin's economy, fueling over 1,800 companies and employing nearly 100,000 people. Wisconsin is first in the nation in paper production and in the value of our forest industry shipments. Over the years, we have

learned the important lesson that the sustainable management of forests is integral to the health of our state's economy.

In addition, many wildlife species find a seasonal or year-round home in forests. Wisconsin's forests are home to over 650 vertebrate species and 1,800 native vascular plant species. Some of these wildlife species are popular game species, such as whitetail deer, ruffed grouse and wild turkey, which depend on active forest management for the maintenance of suitable habitat. Non-game wildlife species such as herptiles, which include salamanders and frogs, depend on breeding habitat in ephemeral pools that form on the forest floor. Likewise, songbirds nest in forested habitats, from fallen snags to high up in the canopy. While some wildlife and plant species thrive on disturbed habitats, other species require large blocks of forest. Through careful inventory, planning and management, sustainable forestry can help create and protect habitats for a wide range of these species.

Invasive exotic species are a growing problem in Wisconsin's forests. Introduced from outside the ecosystem, invasive exotic species can overwhelm a forest stand when there is no naturally occurring predator or competition. Diseases and insects that damage or kill trees (such as dutch elm disease and gypsy moth), as well as plants that competitively take over the forest understory (such as garlic mustard and multiflora rose), present significant threats to forest resources and the ecological, economic and social benefits they provide.

As Wisconsin's human population continues to increase and more people choose to live in wooded areas, the large blocks of continuous forest that historically characterized the state are being increasingly fragmented. In addition, the area referred to as the "wildland urban interface" — where human dwellings and wildland meet — has grown significantly in recent years. One of the most challenging issues in the wildland urban interface is how to protect human life and property from wildfires. Approximately 1,500 fires burn nearly 5,000 acres in the state annually, and humans cause over 98% of these fires. If the current trend of more people building structures in the wildland urban interface continues, forest fire protection and sustainable management techniques that reduce the risk of forest fires will continue to become increasingly important.



Fragmentation presents other problems, as well. Wildlife species that need large blocks of forest may not be able to maintain viable populations in an increasingly fragmented landscape. Water quality

can also suffer when forests are replaced by lawns or impervious surfaces. When roads and vehicles replace trees, air quality is also affected. Activities such as these permanently fragment forests, taking land out of forest and replacing it with other land uses.

Forests are also fundamental to the quality of the places in which we live. Our urban forest does more than just beautify parks and front yards. A tree canopy softens the blow of a downpour, allowing rain to soak more slowly into the ground, reducing flooding and sedimentation into our rivers and lakes. Trees provide shade in the summer and insulation in the winter, reducing our energy consumption. Urban forest, like all forests, make a tremendous economic, ecological, and aesthetic contribution to our communities.



Wisconsin's Forests in the Future: Sustainable Forestry

The needs and values preserved through sustainability can be divided into three categories: ecological, economic, and social. Together, these categories have come to be referred to as the three pillars of sustainability. People rely on forests for their livelihoods, recreation, spiritual renewal, a vast array of forest products, and other essential functions. To ensure that our children and grandchildren are able to experience forests that are as healthy, useful, and abundant as they are today, it is imperative that we work together to ensure our forests are managed sustainably across the landscape.

From its inception, the statewide forest planning process has been driven by a strong commitment to sustainable forestry. While individual definitions of sustainability differ slightly in their details, there is generally broad-based support that sustainable forestry focuses on meeting the needs of current generations, while protecting the ability of future generations to meet their own needs. This definition, combined with the following principles or goals for sustainable forestry, has guided us in the planning process.

GOALS FOR WISCONSIN'S FORESTS

Sustainable forestry aims to ensure healthy and protected forests, a thriving and diverse forest ecosystem, a productive and stable forest products economy, a strong and broadly-shared conservation and stewardship ethic, and a forest resource that provides a wide variety of recreational opportunities. Through the Wisconsin Statewide Forest Plan, we wish to ensure that:



Forests are healthy and protected.

Wisconsin's forest ecosystems provide a multitude of ecological benefits, including habitat for species, water quality protection, carbon sequestration, and moderation of temperature extremes in cities. To ensure the provision of these functions and their many other values, forests are protected from wildfire, insects and disease, including invasive exotic species. Threats to human safety and property near fire-prone forests are minimized through preventative measures and forest fire suppression capabilities.



Forests provide a *diverse* range of native plant and animal species and their habitats.

Wisconsin's forests contain healthy, viable populations of forest-dependent species. Forest community types representing a range of successional stages are maintained to ensure the availability of diverse habitats for species.



Forests are *productive*, providing raw material for consumers *and economic stability* for local communities.

Wisconsin's forests are kept well stocked with merchantable timber to provide an adequate supply of forest products for Wisconsin consumers. Sustainable forestry practices on both private and public lands maximize residual stand quality and promote abundant regeneration of a range of species. Sound forest management supplies local mills and manufacturers with a range of species for fabrication of diverse wood products. Forest products provide income to landowners and a reliable, enduring source of employment for local communities.

Forests are *conserved* and managed with *sound stewardship* practices.

Forest management is practiced on both public and private lands to ensure the forestland base and associated ecological, social, and economic benefits are maintained for current and future generations. Forest management practices are guided by the most current science and are applied based on the desire to maintain the full range of forest ecosystem values, including habitat for diverse species, clean water, air and soil, recreational opportunities for all user groups, and scenic beauty. The direct and indirect benefits of forests depend on a stable forest land base.



Forests provide multiple *recreational* opportunities.

Wisconsin's forests provide opportunities for diverse forms of recreation. These opportunities are expanded, subject to the limitations imposed by available land and fragile habitats, in response to increasing demand. Conflicts between user groups are managed through community planning.



OVERVIEW OF THE STATEWIDE FOREST PLAN

This statewide forest planning effort began with the November 2000 publication of *Wisconsin Forests at the Millennium: An Assessment*. The assessment represents the most comprehensive review of the state of the forests in Wisconsin's nearly 100-year history of forest planning. The plan aims to extensively involve many publics and partners interested in and affected by the ecological, economic, and social benefits of Wisconsin's forests.

The Statewide Forest Plan before you articulates a **common vision** for Wisconsin's forest resources, presenting an **issue-based framework** for achieving that vision through the use of goals and objectives. The framework will **help to develop a future action plan**. Actions can be used for inventory and monitoring, planning and assessment, research and technology, education and public involvement, and policy and management. When used together, these future actions can be effective methods for helping to meet the objectives.

Most importantly, the plan represents a call to all partners and publics interested in working together to address the current and future challenges facing Wisconsin's forests and to catalyze concerted action. When used in combination with the forest assessment report, the plan can help to alert managers, landowners, policymakers, and citizens about the trends and issues that forests and forestry will face over the years.

The development of the Statewide Forest Plan has been guided by a commitment to the sustainable management of **all of Wisconsin's forests**. This plan can provide a framework for cooperative attempts to achieve sustainability by clarifying shared goals and objectives of all stakeholders, and using these goals and objectives to craft concrete actions. The implementation of the plan is the responsibility of all stakeholders, and active involvement and cooperation will be necessary if its ambitious goals are to be accomplished. Integrating the ecological, social, and economic aspects of Wisconsin's forests is critical to ensure the protection and sustainable management of our forests.

The future of Wisconsin's forests will require a shared responsibility. Sustainable forestry will be achieved through cooperative planning and concerted action by all stakeholders, including private non-industrial landowners, the forest products industry, environmental and conservation groups, tribes, recreation groups, universities, and non-government and government agencies at all levels. Effective, collaborative partnerships will be critical to the development of the actions and tools needed to ensure that Wisconsin's forests provide the ecological, economic, and social amenities for use today, as well as those who follow after us.

STATEWIDE FOREST PLANNING PROCESS

The Wisconsin Statewide Forest Plan updates the two previous Wisconsin statewide forest plans, the first of which was published in 1983 and the second in 1990. Previous plans inaugurated a tradition of leadership and of careful management of Wisconsin's forest resources by public, industrial, and individual forestland owners. The plan process was coordinated during a three-year period by the Wisconsin Department of Natural Resources' Division of Forestry in collaboration with local, state, and federal agencies, other private and public sector partners, as well as numerous individual citizens. Collaborative work with publics and partners has been based on the belief that those interested in and affected by forests in Wisconsin are important to the development of the plan. Following is an overview of the planning process, beginning with the forest assessment in 2000 and the anticipated future process for implementing the Statewide Forest Plan.

1. Forest Assessment

Wisconsin Forests at the Millennium: An Assessment provides an assessment of the status of Wisconsin's forest resources from ecological, economic, and social perspectives. The information included in and developed by the report represents the foundation upon which the statewide forest planning process was constructed. Beyond documenting the initial data collection and analysis stage of the forest planning process, *Wisconsin Forests at the Millennium* identified trends and issues that would likely need to be addressed to support sustainable forestry in Wisconsin in the future.

2. Identifying and Prioritizing Trends and Issues That Forests and Forestry Will Face

As a second step towards developing the statewide forest plan, input from citizens, businesses, government agencies and non-governmental organizations identified and prioritized the most important trends and issues Wisconsin's forests and forestry will likely face over the next decades. Public review confirmed the importance of the trends and issues described in the assessment report and identified an additional ten trends and issues. The statewide forest plan ultimately describes fifty-two trends and issues. **Over 2000 individuals and organizations participated in this stage.**

3. Developing Options to Address Each Trend and Issue

Following the identification of trends and issues, preferred options for addressing the trends and issues were developed through the *Developing Options* survey. In the survey, participants were asked to respond to a series of options designed to address each of the trends and issues. Based on the survey, the ecological, economic and social implications were further developed for each trend and issue. **Over 800 individuals and organizations participated in this stage.**

4. Developing Objectives and Actions to Address Each Trend and Issue

An objective was developed for each trend and issue to provide a benchmark for future efforts. The objectives are specific to the trends and issues, yet broad enough to capture the variety of interdisciplinary actions needed to meet the objective. The objectives were drawn from the preferred options identified through the *Developing Options* survey. Respondents provided comment on these objectives and also provided their opinions on possible actions to address the objectives and which kind of organizations (government agencies, NGO's, industry, university, etc.) should address the proposed action. **Over 200 individuals and organizations participated in this stage.**

5. Statewide Forest Plan

The plan includes a common vision for Wisconsin's forests based on five goals and ten principles for statewide sustainable forestry, a description of fifty-two trends and issues, and objectives to address each trend and issue. Each trend and issue write-up contains a summary discussion of the relevant ecological, economic, and social implications, explores relationships among them, and provides a strategic objective. The final plan, published electronically, also includes the possible actions submitted during the final stage of comments. While not fully vetted by public review, these possible actions are included in the electronically published version of the plan to provide this information as a springboard for action in the development of the implementation plan. The opinion about who should implement the actions also shows the breadth, depth, diversity, and scale of public and private efforts across the mosaic of forest types and various ownerships, interests, and geographical settings. The plan also describes frameworks to measure forest sustainability using commonly accepted sets of criteria and indicators.

STATEWIDE FOREST PLAN PUBLISHED ON-LINE

Throughout the three-year planning process, there was a healthy, ongoing tension about how to organize the trends and issues. When they were organized by the common themes of the ecological, social, and economic pillars of sustainability, participants in the planning process often became preoccupied with critiquing whether a given trend or issue was in the right category, or that it should be in more than one category. When asked to link the trends and issues with one or more of the goals of the plan, a core group of forestry leaders provided a wide range of responses. When, for the final phase of review, the trends and issues discussions were simply listed without any organizational framework, feedback was resounding that the write-ups must be grouped in some way to facilitate navigation through the voluminous information. From these experiences, it became evident that different people organize this type of information in different ways, and that to commit to any one organizing principle is to limit the usefulness of the information for those who would organize it in a different way. A promising approach is to publish the plan on-line (electronically) to allow all users to organize information in the way that is most meaningful to them, with each trend and issue (and associated objective) linked to multiple goals of the plan, so that trends and issues can be grouped by goals of interest. The document may also be searched by key word, allowing a user to group all

trends/issues involving, for example, "urban forestry," "fire," "aspen," or "invasive species." Through this approach, the information in the plan becomes more accessible to more users.

Further, electronic publishing allows the plan to be a dynamic and living document. While periodic updates to the assessment, planning, and implementation plans for sustainable forestry are long-standing traditions, using electronic documents creates the potential for a more dynamic approach, in which emerging trends and issues can be incorporated into assessment, planning, and action in a more timely way. The plan and associated information can be found on the Wisconsin DNR Forestry Web site www.dnr.wi.gov/org/land/forestry/look/assessment/

NEXT STEPS

The Statewide Forest Plan provides a unified vision and framework of common goals and objectives to move toward a desired future condition of sustainable forestry in the state. The plan also includes possible actions, or strategies, suggested by publics and partners, to achieve the objectives and begin implementation of the plan. The continued involvement of the public will be important as we move into this crucial implementation phase. Our success will depend on the ability to bring together those who are in a position to identify and implement actions in order to gather information, share existing strategies, and identify new strategies for pursuing each objective while considering ecological, economic, and social implications.

Develop and Pursue Actions to Accomplish Each Objective

Actions are current and future initiatives to help meet each of the objectives. Possible actions, which were identified by reviewers during the final phase of plan review, are provided in the electronic version of the plan, as examples to assist in the future development of an action plan. If forest resources are to be sustained, actions must be identified, developed, and implemented. These actions can and should be worked on by those interested and affected by the issues.

Action Tools

A combination of traditional and innovative tools such as policy and management, research and monitoring, assessment and planning, and education and outreach, will be needed to assist in the implementation of the Statewide Forest Plan. The success of the plan up to this point has been dependent upon the input and investment of individuals and groups from across Wisconsin who have an interest in the future of our forests and forest resources. The implementation of the plan, as well as the development of the tools will provide shared benefits to all current and future Wisconsinites.

November 2004 Governor's Conference on Forestry

In November of 2004, a Governor's Conference on Forestry will bring together citizens, businesses, interest groups, and agencies to identify actions and action tools that can help meet the fifty-two objectives outlined in the plan. The conference will serve as a forum for jointly developing actions with those who have an interest and can influence the future of forestry in Wisconsin, including local, state and

federal agencies, Native American tribes, universities, professional associations, conservation groups, forest-based industries, environmental groups, and forest landowners. Sustainability is a common goal for many public and private interests, and collective efforts such as this conference will be needed to mobilize the skills, capacity, and resources to achieve sustainable forestry.

To bring the fifty-two trends and issues identified in the Statewide Forest Plan into a conceptual framework that would facilitate bringing interested groups of leaders together at the conference, seven themes were described, which collectively include most of the trends and issues from the plan. Key individuals and organizations will champion the development of actions needed to address the trends and issues associated with each of the seven themes.

CONFERENCE THEMES:

- Conserving Wisconsin's Biological Diversity
- Minimizing the threat of invasive species to Wisconsin's Forests
- Enhancing Assistance to Wisconsin's Private Forest Landowners
- Managing the Impacts of Changes in Wisconsin's Land Use and Forest Ownership
- Maintaining Wisconsin's Forest Based Economy Enhancing Wisconsin's Urban Forests Minimizing
- Recreational Use Conflicts in Wisconsin's Forests

MEASURING FOREST SUSTAINABILITY: CRITERIA AND INDICATORS

Are Wisconsin's forests sustainable? Since the Wisconsin Statewide Forest Plan is guided by the premise that a balance of the social, economic, and ecological values of forests is essential to the state and its citizens, the answer to this question is fundamental to measuring the success of the plan.



A number of methods have been developed to measure forest sustainability. Most notable is the framework of Criteria and Indicators for Forest Sustainability developed as part of the Montreal Process. In 1993, representatives from twelve countries—including the United States—joined together in Montreal, Canada, to discuss how sustainable forestry might be defined and measured in terms of outcomes. The product of that meeting is referred to as the Montreal Process, a

framework of Criteria and Indicators for tracking progress in forest sustainability.

The Criteria and Indicators for Forest Sustainability are organized around 7 overarching criterion by which sustainable forestry is measured (see Appendix):

1. Conservation of Biological Diversity
2. Maintenance of Productive Capacity of Forest Ecosystems
3. Maintenance of Forest Ecosystem Health and Vitality
4. Conservation of Soil and Water Resources
5. Maintenance of Forest Contribution to Global Carbon Cycles
6. Maintenance and Enhancement of Long Term Multiple Socioeconomic Benefits to Meet the Needs of Society
7. Legal, Institutional and Economic Framework for Forest Conservation and Sustainable Management.

Within each criterion, several indicators to address the particular criterion are identified. Often multiple variables, or metrics, can be used to evaluate each indicator. Progress in sustainability is determined by evaluating the sum of the indicators for each criterion.

Criteria and Indicators are included in this plan as an example of one tool to measure forest sustainability. Other organizations and forest certification systems have adapted the Criteria and Indicators to their particular needs. The 2000 Wisconsin Forest Assessment does not use Criteria and Indicators directly, but does mention the potential use for future assessments. The Criteria and Indicators may similarly serve us as a useful resource as we begin developing strategies for implementing the plan and ensuring long-term forest sustainability in Wisconsin. The Montreal Process Criteria and Indicators as described in the appendix and the on-line technical resources provide a cross-walk between the indicators and the trends and issues.

VISION FOR THE PLAN

To work in partnership to protect and sustainably manage Wisconsin's public and private forest lands and to ensure the ecological, economic, and social benefits of forests for the citizens of Wisconsin now and into the future.

PRINCIPLES FOR THE PLAN

The following principles, combined with the goals for Wisconsin's forests identified earlier have guided the development of the Statewide Forest Plan.

- 1. Forests Contribute to Quality of Life:** Wisconsin's forests play a significant role in providing for Wisconsin's quality of life including clean air, clean water, biological diversity, employment opportunities, recreational opportunities, environmental education, public health and safety, and beautiful natural surroundings.
- 2. Forests are Sustainable:** Forests should be managed so that current environmental, economic, and social needs are met, while retaining the capacity for these needs to be met in future generations.
- 3. Forests Support a Healthy Rural and Urban Wisconsin:** A healthy rural and urban Wisconsin relies on sustainable forests, and is vital to the quality of life enjoyed by all Wisconsinites.
- 4. Forests are Dynamic in Nature:** Wisconsin's forests are diverse, dynamic, and resilient ecosystems. A broad range of forest conditions exist naturally and continually change. A variety of forest values, in balanced proportion, are mutually compatible over time.
- 5. Forests Should be Managed:** Wisconsin's forests should be managed to keep forests healthy, to preserve native plant and animal species, and to produce the products and benefits that people value. Management can and should include setting aside from active management some lands to serve as ecological benchmarks or to serve other societal purposes.
- 6. Forests Should be Adaptively Managed:** Forest management should be adjusted based on new information and changing values. Policies, programs, and management techniques should be regularly evaluated and appropriately adjusted based upon ongoing monitoring, assessment, research, and technology development.

7. Forests Exist in a Global Context: Wisconsin's forests are important to the global environment, society, and economy. Citizens should consider from which forests lumber and other forest products originate and how those forests are managed when making purchasing decisions.

8. Forests are Owned by a Variety of Landowners Playing Different Roles: Different land ownerships play different roles in meeting the range of ecological, economic, and social needs associated with the forested landscape.

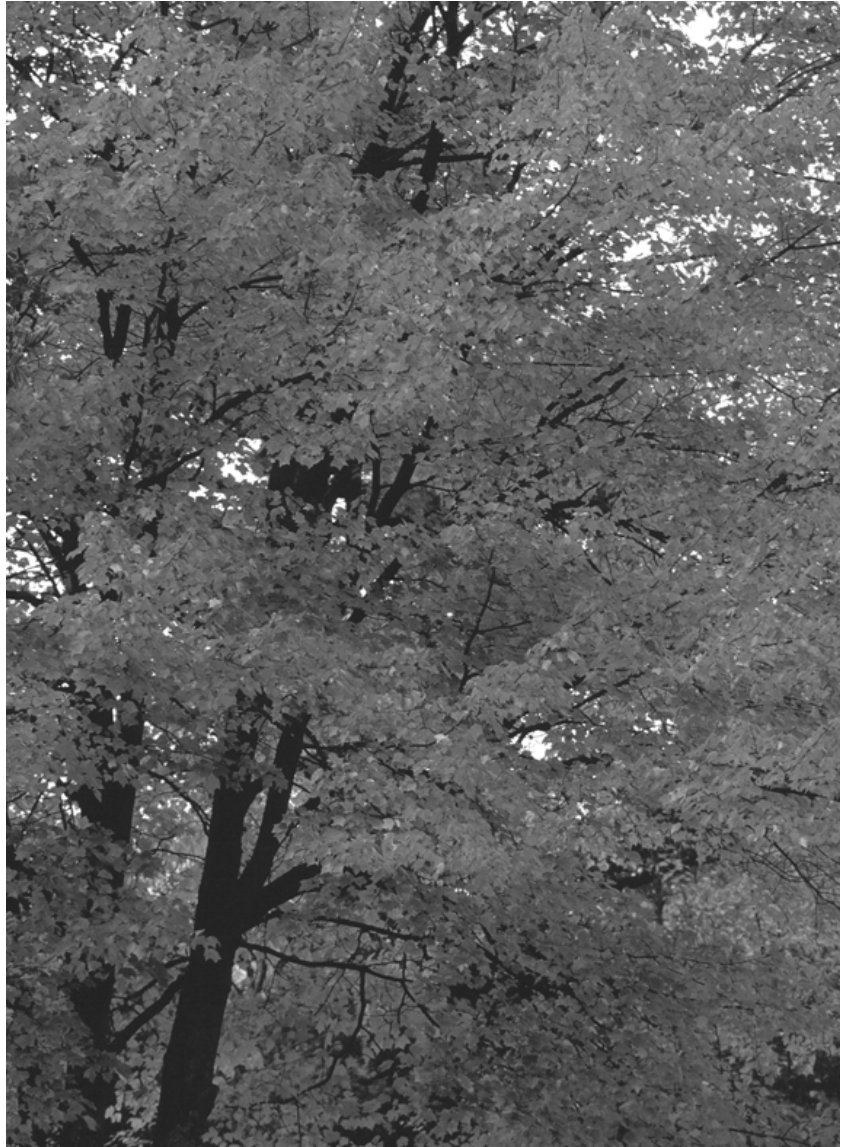
9. Forest Sustainability is the Shared Responsibility of Landowners and the Public: No single entity can be responsible for managing all of Wisconsin's forests. Forest sustainability and intelligent consumption depend on organizations, individual forest landowners, and the public.

10. Forest Sustainability Needs Informed Public Participation: Broad-based, informed public participation and consensus-based decision-making, whenever possible, will best support sustainable forestry in Wisconsin.



TRENDS AND ISSUES WISCONSIN'S FOREST FACE

Wisconsin's forests are ecological, economic, and social treasures. Given that every one of Wisconsin's more than five million residents, and countless visitors, are touched by and depend on the forests of the state it is important to familiarize ourselves with the trends and issues facing our forests and understand the ecological, economic, and social implications to long-term sustainability. This summary of trends and issues has and will help to identify successes and concerns. The trends and issues provide the framework to meet the current and future ecological, economic, and social needs of Wisconsin's forests.





WISCONSIN'S FORESTS ARE AGING AND FOREST SUCCESSION IS OCCURRING.

Objective: Promote continuation of a landscape mix of forests that represent a full array of forest types, age classes and successional stage.

DESCRIPTION

Wisconsin's forests are aging. Most of the state's forestland is a result of regeneration or planting in the early to mid-1900s. Mid-to late-succession maple-basswood forests are replacing the early succession aspen-birch and oak forests of the mid-twentieth century. The forest inventory of 1996 was the first Wisconsin inventory to show more maple-basswood acres than aspen-birch. Aging forests, and associated species composition, structure and function changes, affect economic and recreational opportunities as well as biodiversity.

Ecological Implications

In general, late successional species and cover types are becoming more abundant and early successional ones less abundant. If these successional trends continue, forest types that could increase in abundance on dry sites are soft maple, oak-hickory, and white pine; on mesic sites predominantly maple-basswood; and on wetter sites elm-ash-soft maple, fir-spruce, and black spruce. Forest types that could become less abundant are jack pine, natural red pine, aspen, white birch, and on mesic sites, oak-hickory. On the mesic sites, sugar maple could significantly dominate, and thereby reduce the abundance of many other species for a generation or more. Although, on the average, Wisconsin's forests are aging, different cover types show different trends. For example, the aspen cover type is actually younger due to the large acreage that recently matured and was harvested and regenerated; whereas the maple-basswood cover type is aging due to longer species lifespans and applied management regimes. As forests age, the development of other structural characteristics, such as increased coarse woody debris and large snags, will depend on management techniques applied. Forest aging and succession are not interdependent. Forests may age without advancing successional, or may advance successional while actually becoming younger. Management will determine the successional path of an aging forest. In an aging forest, wildlife species abundance and diversity can be expected to change, with some species becoming more abundant, and some species potentially decreasing in abundance- although other landscape factors will significantly impact relative abundances.

Economic Implications: For most species, forest growth continues to exceed removals. Tree size is also increasing. Consequently, timber volume, and particularly sawtimber volume, is increasing. Larger trees and a different mix of species could require a shift in harvesting and processing technologies and products. Generally, larger, older forests are considered more aesthetically pleasing. This could result in an increase in some forest recreational activities. Conversely, if forest aging causes some wildlife species to become less abundant, hunting and other recreational activities associated with these species may decrease.

Social Implications

As forests continue to develop, those social benefits associated with forest products and recreation may improve. Opportunities for uneven-aged selection management will improve as later successional species become more common. It is likely that there will continue to be conflict about the value and supply of forest resources due to differences in the ways in which individuals value forests.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>



FORESTLAND IS INCREASING.

OBJECTIVE: Encourage additional increases in forestland where appropriate as determined by ecological, economic, and society's needs and values.

DESCRIPTION

Between 1983 and 1996, Wisconsin's forestland increased by 640,000 acres. The trend towards increasing forestland began in the 1960s and is mostly the result of marginal agricultural land converting back to forests.

Ecological Implications

An ecological benefit of the increase in forestland is the additional habitat it provides for forest dwelling species. Different species utilize openlands, and may be negatively affected by the conversion to forest. The relative abundance and distribution of forest and openland, in any combination will benefit some species and negatively affect others. Openland habitat may be more appropriate in some parts of the state, and forest in other parts, depending on habitat scarcity, species needs, and suitability of the land area in question. Carbon sequestration is another benefit of the increase in forestland; reforestation is thought to be a way to mitigate global warming associated with CO₂ buildup in the atmosphere.

Economic Implications

The increase in forested acreage between 1983 and 1996 represents 4% of currently forested lands. This rate of increase has been about the same since the 1960's. If the trend continues, increases in forested land could have a slight positive economic impact on forest-dependent sectors (timber production and tourism) when the new forests reach maturity.

Social Implications

Social effects of the increase in forestland are difficult to quantify. Forests are desirable to many people, and are one factor that draws people to the North Woods for recreation, second home development, or new primary homes. The additional forests may eventually contribute slightly to quality of life. However, early in the process of succession, old fields may detract from scenic quality and have a slight negative impact on development.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>



SOME TREE SPECIES ARE DECLINING.

OBJECTIVE: Encourage the maintenance of native tree species within forests and the presence of forest types that are becoming uncommon.

DESCRIPTION

Some tree species have declined or effectively been removed from Wisconsin's forests. American elm and butternut have declined in recent years. Dutch elm disease, butternut canker, and chestnut blight have negatively affected these beautiful and valuable tree species. Some individual trees show resistance to the various diseases, but not enough to hope for recovery in the near future. Jack pine and the jack pine forest type acreage are also decreasing. Much of the acreage is being replaced with other pine or oak species. The oak in particular reflects a later successional type due to a management choice or lack of disturbance, primarily fire.

Ecological Implications

American elm, formerly a major component of bottomland forests, is reduced or eliminated in certain areas. It has been replaced by silver maple and black ash. The wetland forest biodiversity has been reduced. Butternut, a valuable nut species and formerly a minor component of northern and southern Wisconsin mesic forests, is now missing from most stands. Over 90% of the residual butternuts are infected with the butternut canker. Regeneration is occurring but limited. Over 50% of seedlings are infected by the canker disease. Jack pine is a colonizing species in dry sandy soils and a major component of pine barrens are greatly reduced in area and volume in the sandy areas of the central counties and the northwest.

Economic Implications

The supplies of elm and jack pine, both valuable (for lumber and pulp) species, are limited. Butternut, a valuable species for wood-carving and specialty-products is seldom available.

Social Implications

American elm was one of the most popular shade trees in the United States. It was an ideal shade tree in its ability to provide heavy shade and to endure the many stresses in the urban environment. Norway maple and green ash have commonly been used in the urban landscape as replacements for American Elm.

ACTIONS

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THERE IS LIMITED OAK REGENERATION IN SOUTHERN WISCONSIN.

OBJECTIVE: Encourage the maintenance of oak within forests and the oak forest type.

DESCRIPTION

On a statewide basis, oak-hickory acreage increased slightly between 1983 and 1996 (primarily on very sandy sites); however, acreage decreased in southern Wisconsin. This trend is most likely a result of aging, concentrated oak-hickory forests in southwestern Wisconsin with continued heavy selective harvests, which increase the rate of succession to elm-ash-soft maple and maple-basswood types on more mesic sites. This, in conjunction with the difficulty in regenerating the mid-tolerant northern red oak on good sites in southwestern Wisconsin and the resulting large decrease in seedling-sapling acreage, provides support for a continued decreases in oak-hickory acres and the red oak species in southern Wisconsin.

Ecological Implications

In southern Wisconsin, a landscape extensively impacted by fire and characterized by a mix of prairies, savannas, oak forests, and some mesic hardwood forests has shifted to one that lacks fire and is characterized by development, agriculture, oak forests, and some mesic hardwood forests. These oak forests are now converting, through natural succession and partial harvesting of the oaks, to mixed mid-tolerant and mesic tolerant hardwood forests where oak is being reduced to the role of another mid-tolerant associate. In many cases oak forests are converting to a mid-tolerant mix of oak, black cherry, elms, hickories, red maple, and sometimes a dense shrub layer. If natural seed sources are available, these are moving towards sugar maple, basswood, and ash. However, as long-lived and abundant as the oaks are, they will continue to be a part of this landscape for a long time. Structural and functional characteristics have already changed dramatically (and almost completely) since Pre-Columbian times. Further changes can be expected as these forests mature and succession proceeds. These changes in the forest will influence biodiversity and wildlife richness and abundance, with species specific changes responding to the abundance of preferred habitat and food. However, in this landscape, land use, invasive exotic species, fragmentation, and the availability of other habitats are also important determinants of species richness and abundance.

Economic Implications

Oak has higher value lumber than many of the species replacing it. As oak representation diminishes, relative stand timber value can be expected to decrease somewhat. Inefficient sawmills, and the jobs they provide in the region, may go out of business faster with the necessary conversion to other, lower value species. Over the longer term, on mesic sites, uneven-aged management of tolerant hardwoods can provide a viable and competitive alternative. The shift away from oak is not expected to have significant impacts on tourism. Potential hunting opportunities could decrease due to a decrease in mast production, but many other food sources are available in this fragmented landscape.

Social Implications

Conversion of oak forests to more tolerant types will enable less aggressive and visually dramatic harvest and regeneration techniques. Oak is a popular species; its decreasing abundance may cause concern for oak enthusiasts.

ACTIONS

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DESCRIPTION

We are still exploring and learning about biodiversity and what it means to human beings and to the forest. There are clearly holes in our knowledge. For example: We do not have a good understanding of the diversity of Wisconsin's non-vascular plants, invertebrates, or herptiles.

Genetic diversity within species or populations is something we are just beginning to examine.

The relationship of forest composition and structure to ecosystem function—a critical piece of the puzzle—is not well understood beyond some basic knowledge of nutrient and energy cycles.

An understanding of the different scales at which biodiversity is important is also just emerging.

The positive and negative impacts of forest succession on species diversity are not well known.

The role of reserves, buffers, and corridors need further study to clarify the relationship with conserving biodiversity.

The importance of coarse woody debris within forest is a stand attribute that can be managed for; however, guidelines need to be developed for various forest types and sites.

Monitoring management activities and developing feedback mechanisms need to be refined in order to understand forest changes and subsequent adaptive management.

Ecological Implications

Wisconsin's biological diversity is a very complex issue. It involves thousands of species, their habitats, and their interactions with each other and the environment, including humans. Assessments of biological diversity have been conducted at global, national, and statewide scales, and hundreds of books have been written. Still, we lack detailed information, particularly about less-common species and their ecological relationships at a scale suitable for evaluating management alternatives.

There are many ways of measuring biological diversity, and conclusions about ecological implications depend on the measurement and the spatial and temporal scale. Biological diversity (as measured by the number of different species present) can be increased at a local scale by adding generalist species, but this can negatively affect other species and reduce overall biodiversity in the region. Not all species are equally important in planning for biological diversity. At issue is which species are present, rather than how many.

Biological diversity at a broad scale, such as a continent, is considered beneficial because a large variety of species provide materials, food, and medicines that people use. This vast web of species is also involved in supporting ecosystem function. Some of their roles are known, such as the function of insects in pollination. Sustainability and forest productivity depend partly on some level of biological diversity, but much remains to be learned about these relationships and thresholds.

Biological diversity has been reduced in the United States since Pre-Columbian times. Of the 20,892 known vertebrate and vascular plant species, 1% are presumed to be extinct, and another 31% are considered at risk (global conservation status ranks of vulnerable, imperiled, or critically imperiled). In Wisconsin, there are four species presumed or possibly extinct, and less than 3% of vertebrate and vascular plants are considered at risk. Thus, we have relatively good opportunities to conserve most of our native species.

Economic Implications

Biological diversity has direct economic value as a source of materials, food, and medicines. It also has indirect value in providing ecosystem services - for example, bird species limit populations of insect pests, and wetland plants filter pollutants and sediment from aquatic systems. Income from forest-based tourism and recreation is largely dependent on the vegetation and wildlife found in an area. Sometimes, conserving certain aspects of biological diversity is part of the reason for protecting land areas from the effects of humans. Reserved areas can create economic impacts due to restrictions on resource production or motorized forms of travel. Currently, 1.3 % of forested lands in Wisconsin are in a reserved status. Gathering information about biological diversity is expensive, requiring detailed research, inventory, and monitoring.

Social Implications

Generally, people do not want species to become extinct. Some are concerned about potential consequences, including the failure of ecological systems to function properly. Others are worried that future generations will lack materials, food, and medicines, or may have a diminished quality of life. Still others have ethical and religious beliefs about maintaining life on Earth.

Some people are not very concerned about the loss of biological diversity, reasoning that many species are of little importance to humans, and that the Earth is so resilient that other species or ecological functions will develop to compensate for those that are lost. They may also feel that protection measures interfere with human resource use and economic development, and are too expensive. The lack of appropriate information about biological diversity can result in poor land use decisions, incorrect assumptions by the public, and questions about land use.

ACTIONS

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IT IS A CHALLENGE TO MAKE SCIENTIFIC INFORMATION RELEVANT TO DECISION-MAKING.

OBJECTIVE: Develop tools and strategies for improving the communication of forest science information to the public.

DESCRIPTION

Forests are complex. Describing even what we do know about forests in ways that can be readily understood and used by people who want to participate in planning for future forest management is an increasing challenge for natural resources professionals. The good news is that with tools such as Geographic Information Systems (GIS), we can provide very useful visual aids to help people think about multiple layers and scales of information.

Ecological Implications

Forest systems are typically complex and often not fully understood. The information that exists about the ecology of forests has traditionally been written by and for scientists and is not easy for non-scientists to understand. Ecological information is often developed only in the context of ecology and is usually not integrated with any social or economic information.

Economic Implications

Wisconsin's forests support a major component of Wisconsin's economy, through production, tourism, and employment. The paper industry, the tourism industry, and secondary wood products industry are all primary users of our forests and employers of our citizens. So the forces of economic supply and demand play a powerful role in the wants, needs, and values that many citizens have for forest resources.

Social Implications

For the purposes of natural resources protection and management, "social" information generally means information about what people want, need, and value from the natural resources of their neighborhood, state, and beyond. In recent years, citizens have become much more informed and involved in decision-making about Wisconsin's forests, and they want a meaningful opportunity to participate. More than ever, public policy about protecting and managing Wisconsin's forests must address the concept of multiple use, whereby many different – and sometimes conflicting — wants, needs, and values are acknowledged and provided for.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>



THE LIST OF THREATENED AND ENDANGERED SPECIES IS GROWING.

OBJECTIVE: Protect threatened and endangered species and support inventory and research on biological and ecosystem diversity.

DESCRIPTION

Currently there are 33 threatened and 34 endangered Forest species listed on either the Wisconsin or federal endangered and threatened lists. These numbers are up from 1985, the time of the last assessment. These latest listings are concentrated in the invertebrate and plant categories. The increase in listed species is largely due to our increasing knowledge about a wider variety of species and their habitat needs.

Ecological Implications

In addition to the 33 threatened and 34 endangered species directly associated with forests, there are many additional listed species whose populations may be affected in part by forestry activities. In Wisconsin, there are currently a total of 133 endangered and 106 threatened species, and many additional species of concern. Usually, these species are not harmed by activities that use ecosystem-based sustainable forestry practices. Several types of rarity can lead to listing: some species are “specialists” that are naturally restricted to uncommon habitats; some species are scarce within abundant habitat because of life history factors; others are at the edge of their range. Another category of species is listed because their populations have declined to low levels, primarily due to habitat loss or degradation, or for a few, exploitation (overhunting or overfishing) or persecution. Species are occasionally delisted when additional inventory information indicates that the species is more common than previously believed, or when population trends are reversed and the species becomes more common.

While most Wisconsin species are not monitored for population trends, a number of bird species are known to have declined significantly since the 1960’s, based on BBS (Breeding Bird Survey) information. These include olive-sided flycatcher, eastern wood-pewee, wood thrush, very, golden-winged warbler, and indigo bunting. An additional group of birds has declined during the past decade. These monitoring results provide support for the assertion that some species are becoming increasingly rare.

The major ecological implications of increasing species rarity are that extirpation or extinction becomes more likely, and that ecosystem functions can be affected. Although extinction is a natural process, current and projected rates of extinction worldwide are much greater than what would be expected without effects of humans. And, while past human-caused extinctions were largely due to exploitation, future extinctions are expected due to continued loss, degradation, and fragmentation of habitats. The loss of species could affect ecosystem functions like pollination and nutrient cycling, although the exact role of any given species is usually not known.

Economic Implications

Some species have direct economic value as a source of materials, food, and medicines. Although we would not ordinarily use rare species in these ways, future generations may find them useful, particularly for genetic material. Rare plants are sometimes propagated for sale, and command a high price. Theft of wild plants and animals is a problem because their value on the black market is very high. Some rare species may be valuable in providing ecosystem services like pollination and nutrient cycling. Some tourism is based on rare species, such as at the International Crane Foundation’s center near Baraboo, where people visit to observe a variety of rare cranes.

Protection and management of threatened and endangered species can be very expensive in some instances, and may limit some uses of resources.

Social Implications

Most people do not want species to become extinct. Some are concerned about potential consequences, including the failure of ecological systems to function properly. Others are worried that future generations will lack materials, food, and medicines, or may have a diminished quality of life. Still others have ethical and spiritual beliefs about maintaining life on Earth.

Some people are not very concerned about potential losses of species, reasoning that many of them are of little importance to humans, and that the Earth is so resilient that other species or ecological functions will develop to compensate for those that are lost. They may also feel that protection measures interfere with human resource use and economic development, and are too expensive.

Forest systems are typically complex and often not fully understood. The information that exists about the ecology of forests has traditionally been written by and for scientists and is not easy for non-scientists to understand. Ecological information is often developed only in the context of ecology and is usually not integrated with any social or economic information.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>

DESCRIPTION

Human activities—trade, travel, landscaping, gardening, and recreation—have resulted in many species not native to Wisconsin being introduced to the state. Some of these new species are very invasive and may cause problems in native ecosystems. Invasive exotic species often have few if any competitors or predators, making it easy for them to take over an ecosystem, significantly altering the structure and diversity of the system. The gypsy moth, Asian long-horned beetle, Dutch elm disease, garlic mustard, and Japanese honeysuckle are some of the exotic species that have invaded, are invading, or pose a future threat to Wisconsin’s forests. Urban forests may become a focal point in a conflict between the traditional horticultural industry and ecological preservationists. Control measures for non-native species are often particularly controversial in developed areas.

Ecological Implications

The loss or reduction of native trees, shrubs and herbaceous plants due to invasive exotics has a cascading effect on the fauna that depend on them. For example, gypsy moth defoliation reduces the oak acorn crop for several subsequent years; consequently, natural reproduction is reduced and many animals that depend on acorns for food will be potentially reduced or lost to the ecosystem. The loss of shrubs and herbaceous plant species causes a reduction or loss of many insects, birds, rodents and the predators that feed on them. Invasive exotics will invade natural remnants in urban areas, crowding out the native plant species and often the wildlife that feed on the native plants. This reduction in biodiversity will set up the ecosystem for further devastation by individual pests, pathogens or abiotic conditions, and may result in potentially serious unknown and unpredictable effects on the balance of the ecosystem such as outbreaks of pest species. Conversely, exotic plant species play an important part in maintaining biodiversity in the highly disturbed urban ecosystem where native species are often not adapted to the harsh conditions of streets and landscaped yards.

Economic Implications

Elm and butternut are no longer available as a raw product for the timber industry. Oak species are present at reduced levels following gypsy moth outbreaks. The loss of oak shade trees reduces residential property values. Commercial camping industry loses income during gypsy moth outbreaks. The potential impact of white pine blister rust has discouraged land managers from planting this species thus reducing its availability as a source of wood products. Millions of dollars are spent annually by government and private sector to control gypsy moth, garlic mustard, buckthorn, and other invasive species. Control of invasive species themselves and of outbreaks of

pests or pathogens is difficult and costly, taking the limited funds away from routine management. Control efforts must cross jurisdictional and property lines requiring cooperation between thousands of landowners requiring substantial cost beyond the physical control programs. The ecological purist would ban and eradicate all exotic species. However, landscaping is a \$1.3 billion industry in Wisconsin which depends to a large extent on exotic species and many of the economic benefits of the urban forest – increased property values, energy savings, business attraction, improved sales – would be lost

Social Implications

There are strong philosophical differences on both sides of the exotics issue. Control measures, particularly pesticides, are likewise controversial, creating further conflict among property owners.

Recreational opportunities are lost due to high gypsy moth populations that many people find repulsive. Anxiety is intense and homeowners feel that their quality of life is reduced during outbreaks. Citizens blame governmental agencies that are unable to respond to various problems caused by exotic species leading to loss of governmental credibility. Citizens put pressure on governmental agencies to act.

ACTIONS

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SOME BIOTIC COMMUNITIES AND IMPORTANT DEVELOPMENT STAGES OF BIOTIC COMMUNITIES ARE RARE.

OBJECTIVE: Protect rare ecosystems and support continuing inventory and research on biological and ecosystem diversity.

DESCRIPTION

Savannas, barrens, prairies, certain wetlands, and advanced forest successional stages are natural communities or ecosystems that have become extremely rare. Savannas, for example, were once common ecosystems that are now very rare. They have been converted to farmland, succeeded to forest, or changed in land use to urban development. Barrens were historically rare and now have become globally imperiled. These forest systems have also been altered in their composition, for example through increased plantations or stocking of trees in barrens and savanna, as well as through fire suppression in systems that are fire-dependent. Hemlock relicts are declining due to deer damage, poor regeneration, and conversion of land to other uses. Common ecosystems present concerns due to changes in integrity. For example, riparian forests are becoming significantly degraded. Human activities are influencing communities along rivers and streams. Development, agriculture, and pollution have affected many riparian forests, affecting the native biodiversity.

Ecological Implications

Rare community types in Wisconsin and the Great Lakes region have been identified through several efforts undertaken by different agencies. The more general assessments have noted the rarity of prairie, savanna, barrens, and certain types of wetlands. Statewide assessments have emphasized the lack of prairies, oak savannas, and pine and oak barrens. The Wisconsin Natural Heritage Inventory lists 102 natural communities that are rare in the state. Of these, 37 are identified as threatened or endangered. Some of these are naturally rare, like caves and talus slopes, but others were once widespread and have potential for restoration. Rare community types tend to include rare species, and maintaining their integrity is important in conserving the rarer components of biological diversity in the state.

Concerns about rare biotic communities are focused on component species that are declining or not regenerating, as well as the restricted extent of some other community types. Forest managers have been concerned for some time about regeneration of cedar, hemlock, yellow birch, and in some cases, oak forests. Efforts are ongoing in developing regeneration techniques, but meanwhile these forest types may decline further. A number of restoration projects have been conducted in pine and oak barrens, and oak savannas. Restored areas are small compared with the former extent of these community types, and additional restoration may be needed to prevent declines of species' populations that use them.

Rare natural features of small extent are often contained within a forested matrix. These may include different types of wetlands, ponds, lakes, and streams. Other features less frequently found in forests are seeps, cliffs, rookeries, hibernaculums, and caves. Usually, these

natural features and the biotic communities they support are not harmed by forestry activities that use sustainable ecosystem-based management practices. However, development and some recreational activities may affect them. Additional declines of rare communities would lead to the effects discussed in the biological diversity issue. Old-growth forests are very rare because they were nearly completely removed in the "Cutover" period of Wisconsin's history (generally 1890's). There currently is very little forested area dominated by trees older than 120 years. The lack of old-growth forests results in lower populations or concentrations of species that prefer or are more productive in them, and may have other ecosystem effects. Additional discussion is found in the issue, A11, "Stands of old forest are rare".

Economic Implications

Some rare ecosystems support species that have potential economic value as a source of materials, food, and medicines. Some of them are valuable in providing ecosystem services; for example, wetlands are effective in trapping pollutants and sediments. Some tourism is based on rare ecosystems; for example, people will travel to observe a prairie remnant or a cave, and for recreation on or near lakes. If areas are designated as reserves to protect rare communities or features, the opportunity for direct resource production from these lands is precluded. Currently, 1.3 % of forested lands in Wisconsin are in a reserved status. Also, there are economic costs associated with incorporating conservation measures into sustainable forest management practices.

Social Implications

Many people value Wisconsin's natural communities, feeling a connection to lakes, rock formations, and other natural features, some of which are historic communities. They are concerned when these areas are destroyed, disturbed, or degraded. Declines of rare ecosystems also lead directly to declines of rare species. Consequences of species loss are discussed in the issue; "Information about biological diversity is scarce."

ACTIONS

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OBJECTIVE: Manage for healthy, vigorous forests that are more tolerant of insect outbreaks and disease and of human-related impacts.

DESCRIPTION

Forest disturbance patterns have changed dramatically over the past century. This has resulted in significant impacts upon forest composition, structure, and function. Once, the dominant short-term disturbance factors in Wisconsin's forests were windthrow, fire, disease, and severe weather. Today, fire has been widely suppressed in our forests. Human-caused disturbance is now predominant in Wisconsin's forests, while disease, windthrow, and severe weather continue as disturbance factors. Various types, intensities and timing of disturbance have different impacts on forest composition, structure and function.

Ecological Implications

Disturbance regimes (type, timing, and intensity) have changed significantly in recent history. In Pre-Columbian times, fire was an important agent causing disturbances ranging from light and small to intense and large. This agent of forest change has been dramatically reduced (see Issue A14). Characteristics of other agents of disturbance have also changed, including insects, disease, animals, wind, ice, and flooding. Significant new disturbance factors have been incorporated into the forest ecosystem, including climate change, pollution, exotic pests, human recreation, logging, and land use conversion. Because of these changing disturbance patterns, relative abundances and distributions of forest cover types and successional stages have changed significantly, affecting other plants and animals that are part of these systems.

Insect and disease infestations may remove a single species, hasten succession, or alter species composition in forest stands. Oak wilt and the two-lined chestnut borer, butternut canker and Dutch elm disease have all reduced the incidence of specific tree species in either very localized areas or statewide. The jack pine budworm has played a significant role in killing mature to overmature jack pine. Heavy defoliation of hardwoods by insects causes mortality to suppressed and weakened trees and initiates decline of more vigorous trees. Depending on the tree species involved, succession may be hastened as understory species are released or species composition may change if the site is suddenly receiving more sunlight and conditions encourage the growth of intolerant species. Wildlife habitat quality and quantity may change as patches of declining hardwoods die and added sunlight to the forest floor encourages the temporary growth of shrubs. This undergrowth may serve as shelter for birds and small mammals. Dead trees harbor insects for birds, perches for raptors and provide den sites. However, too many dead trees can reduce mast as a source of food and temporarily reduce water infiltration and increase runoff.

Severe downburst windstorms cause significant localized damage to forests through wind throw, defoliation and severe injury. Large wounds, cracks and stem failure reduce vigorous trees to weak and low vigor trees. Low-vigor trees are more susceptible to insects and disease. Windthrow of one or a few trees was the dominant form of disturbance in hemlock-hardwood forests in Pre-Columbian times, creating small gaps throughout the forests. Gap formation continues, but at a lower rate in today's younger forests. The lack of small forest gaps may be a factor in the decline of some species. Human disturbance in forests occurs from recreational and timber harvesting activities. Forests are generally thought to be resilient to these impacts, but there are concerns about long-term cumulative effects of soil compaction, root damage, nutrient removals, increased herbivory and reductions in ground-flora abundance. These stressors have contributed to forest decline in Europe; they weaken trees and make them more susceptible to insects, disease, and effects of pollution.

Economic Implications

Insects, diseases and major windstorms often cause decline and mortality of timber before they reach economic maturity. Time and money invested in growing species is lost. Resources may have to be spent on unplanned harvests and site preparation to minimize losses and initiate regeneration. Severe defoliation or widespread mortality of Wisconsin's forests reduces their aesthetic value and can have an impact on revenues from tourism.

Social Implications

Some insects present a health hazard, especially the gypsy moth, through the release of body hairs. People with respiratory illnesses will be particularly susceptible to irritation by the widespread presence of these hairs. Dieback and mortality of trees can produce hazardous situations if the trees are located in areas where the public frequents. Injuries from falling branches or failing trees must be minimized, thus hazardous trees will have to be removed. If the quality or quantity of wildlife habitat is reduced, hunting opportunities may also be reduced for a variety of game species.

ACTIONS

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OBJECTIVE: Conserve, protect, and manage old growth forests, and where feasible encourage their appropriate representation on the variety of ownerships.

DESCRIPTION

The term “old forest” is, in this case, used to designate relic forest, old growth reserve, managed old growth, extended rotation, and miscellaneous old forests. Old forests in Wisconsin has been relatively rare, with notable exceptions of stands of old forest in the Menominee Forest (Menominee County), on Goodman Timberland, and in the Connor Forest (Marinette, Forest and Florence Counties). What remains is scattered across the state in very small parcels, mostly in cedar bogs or spruce swamps. Our aging forests provide opportunities to manage for old forest.

Ecological Implications

The primary forests of Wisconsin, which existed into the 1880’s, were considerably older than present forests. One study estimated that trees older than 120 years dominated 90% of the area of hemlock-hardwood forest. Almost all of the primary forest was removed in the Cutover, and the current forest is now largely in the 20-80 year old age-classes. Forest stands with dominant age-classes older than 100 are uncommon. Data from the latest inventory cycle show that total acreage of stands older than 100 years decreased between 1983 and 1996.

There are ecological benefits associated with landscapes that contain old forests and old-growth as an integral element. Ecological simplification is reduced and biological diversity is augmented. Compositional, structural, and functional diversity are increased. Until recently no known old-growth obligate species (species that can exist only in old-growth conditions) had been identified in Lake States forests, however a group of lichens has been identified which appear to be obligate on old-growth. Some bird species are more productive in old forest and old-growth. Coarse woody debris, which is abundant in some old forests, and pit-and-mound topography, created by treefalls, are known to be important habitat features for some plants and animals.

Specific ecological values of old-growth forests in Wisconsin and the eastern US are largely unknown, because stands and larger forest patches are rare. Old-growth forests, with their relatively undisturbed conditions, provide reference points for the study of ecological characteristics and for comparison with managed forests. One benefit of allowing some managed forests to age would be to learn more about the functions and values of old forests.

Economic Implications

Forests provide ecosystem services and support species that have direct economic value as a source of materials, food, and medicines. Old forests may provide different kinds and amounts of services and supplies. For example, managing for older forests may reduce total timber volume yields, but increase large sawtimber and veneer yields. Older forests have increased risks of losses in timber value. Designation of stands and forested landscapes for the development of old-growth reserves would eliminate direct material resource production from these lands. Tourism could benefit somewhat from additional old forestland, as people will travel to observe these areas. Populations of popular game species could decline in some landscapes with a large component of older forests.

Social Implications

Old forests provide a human environment with educational, aesthetic, and philosophical values. Some people value old forests, feeling a connection to them as a significant natural feature that was part of Wisconsin’s heritage. Social conflicts arise from different values assigned to different ecological, economic, and social implications associated with different levels of landscape representation of different kinds of managed and reserved old forests.

ACTIONS

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THE FOREST IS BECOMING MORE FRAGMENTED.

OBJECTIVE: Work to minimize forest fragmentation and explore techniques that would allow fragmented forests to retain a larger portion of their ecological, economic, and social benefits.

DESCRIPTION

Permanent fragmentation is the process of converting large contiguous areas of forest into smaller patches of forest and non-forest land use in ways that do not allow the forest to regenerate. In contrast, habitat fragmentation temporarily decreases the continuous area of a similar-aged or structured forest, which may negatively affect some species. Temporary habitat fragmentation occurs naturally through agents such as fire, windthrow, or severe weather. Humans can also increase the rate of permanent or habitat fragmentation in Wisconsin's forests. Road building, agriculture, and urban development all contribute to permanent fragmentation, whereas timber harvest contributes to temporary habitat fragmentation. However, there are dramatic differences between the impacts of temporary habitat fragmentation, such as timber harvest, which provides for regeneration of the forest, and fragmentation under conditions that create permanent or very long-term alterations to forest systems, such as development and agriculture. Like many of the issues identified in this section, this one is much debated.

Ecological Implications

There are several ecological effects of forest fragmentation. Permanent fragmentation results in long-term habitat loss, which is widely held to be the greatest threat to species survival. This type of fragmentation also creates areas that some wildlife species are unable or unwilling to cross, or where they are more likely to be killed. "Edge effects" occur at the boundaries of two distinctly different habitats. Effects are most severe at boundaries between forests and open areas, and last longest where forest adjoins permanently fragmented areas. Habitat fragmentation is not so long-lasting; even in the most extreme cases, where the forest is completely removed, effects are mitigated for most species within several decades.

Some forest plants and animals benefit from edge conditions, while others are harmed. Species composition alters toward "generalist" species that can tolerate disturbance and a variety of habitats. Generalists include many common prey species that provide food for hawks, bobcats, and other predators. Some species are habitat "specialists" that can be negatively affected by some types of edge. Effects have been most often studied on Neotropical migratory birds (NTMB's) that winter in tropical areas and migrate to the Lake States to nest. Many NTMB's have undergone severe population declines during the past 30 years. Some of these bird populations have declined partly because of edge effects, including competition for food or nest sites, predation, or nest parasitism. Edge effects are worse for NTMB's in southern Wisconsin, because forests there are permanently fragmented within an agricultural landscape. These forest patches have more edge, and cowbirds are common nest parasites.

"Area effects" are related to the size of habitat patches, as well as their distribution. Some species are "area sensitive", showing a preference for large habitat patches where they can presumably avoid predation, human disturbance, or edge effects. Fragmented landscapes have more edge and fewer large habitat patches. Such landscapes are

less suitable for area sensitive species with specific habitat requirements. At a broader spatial scale, "landscape effects" are due to cumulative changes in land use, forest composition and age-class structure, and the size and arrangement of different kinds of habitat patches. Some NTMB's tend to avoid landscapes that contain a lot of open land.

Economic Implications

Permanent fragmentation is associated with development, which has both positive and negative effects. Some types of development can attract increased tourism and associated revenue, but industrial and/or residential development in forest-based recreation areas could reduce the destination desirability for visiting tourists. Also, some developments require additional services like police and fire protection that cost communities more than they receive from increased tax revenues. Habitat fragmentation associated with timber harvest provides income and products, but can sometimes have a temporary negative effect on scenic quality. Harvests can also improve visual quality by reducing forest highway tunnel effects, or opening views of lakes and hills. Permanent fragmentation reduces the available forest product base. This can result in detrimental impacts on local forest-dependent economies. With increased competition and land prices for a smaller, more fragmented forest land base, ownerships become smaller and landowners are less likely to harvest timber or draw interest from timber buyers if they are willing to harvest.

Social Implications

Permanent fragmentation has a much greater social effect than habitat fragmentation. Some people enjoy living and recreating in highly developed areas, while others prefer a more rustic setting with relative solitude. As Wisconsin's landscape becomes more developed, particularly for seasonal homes, local cultures change. Seasonal residents and new permanent residents often develop additional home sites in the forest, resulting in permanent fragmentation. Surveys show that these new residents tend to favor non-commodity uses of the remaining forest, while long-term residents favor a working landscape with more habitat fragmentation but less home site development. Forestland prices are increasing dramatically in Wisconsin. Many landowners are forced to sell as a result of increasing property taxes, or may be lured to sell to make a large profit. Division of these lands into smaller, more affordable parcels drives the fragmentation cycle. Residents that lack knowledge about the ecological implications of fragmentation can worsen its effects by clearing additional areas near home sites for views or lawns, introducing non-native species, and encouraging generalist wildlife species.

ACTIONS

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AVERAGE ACREAGE BURNED BY FOREST FIRES HAS DECLINED.

OBJECTIVE: Monitor and assess the growing wildland-urban interface and continue to support forest fire prevention, detection, and suppression efforts and public education campaigns designed to minimize the threat of forest fires.

DESCRIPTION

Great strides have been made in controlling forest fires since initial efforts to suppress fires over 90 years ago. Today and historically the vast majority of forest fires are human-caused. The annual acreage burned in Wisconsin has steadily declined over time with improvements in forest fire detection and suppression techniques, saving lives, property and forest resources. However, weather continues to play a critical role in determining the number and extent of fires in any given year. It has been more than a decade since Wisconsin has experienced prolonged severe fire weather.

Ecological Implications

Severe forest fire seasons and acreage burned annually by forest fires are very dependent upon the current and past weather conditions, especially when Wisconsin experiences severe periods of drought. Historically, drought and associated bad forest fire year's runs on a cycle of every ten to twelve years. During periods of drought the number of forest fires increases, the fires are larger, burn more intense and burn for a longer period. Significant drought periods in Wisconsin occurred in the early 1960's, 1976 through early 1980's and in the late 1980's through the early 1990's. Over the past fifty years in Wisconsin's DNR organized protection areas there has been on average 1624 fires per year. These fires annually burn on average 8,087 acres. During the 1990's the weather during the spring fire season was moist and mild resulting in number of fires remaining close to the fifty year average, but the acreage burned being significantly less than the fifty year average on an annual basis. Reasons associated with the reduction in acres burned during the past decade; improved forest fire fighting equipment, increased partnerships with local fire departments, improved fire training of department and local fire department personnel and increased partnerships with federal agencies.

Economic Implications

Forest fires can have a significant impact on the areas that they have burned. Especially if they destroy the current timber resource and the future seed trees to regenerate the area. Severe forest fires can also sterilize the soil, which in turn will affect the ability of plants to germinate. This leaves the soil exposed to wind and rain erosion. As more marginal farmland is converted to vegetation and more homes are built in forested areas, the threat of forest fires and the loss of structures to forest fires will continue to increase. This is especially true in the wildland urban interface area of Wisconsin, where communities and forestland intermix.

Social Implications

With continued population growth, fragmentation of forestland and construction of primary and secondary homes in the forested areas of the state, the wildland-urban interface area continues to expand in Wisconsin. It is primarily in this wildland-urban interface area that wildland fire causes structural losses to occur. Because more and more people like to live and recreate in forested areas, this will cause more structures to be imperiled by future forest fires. During a forest fire, significant amounts of smoke are generated, which can have significant impacts on people that have respiratory problems. Smoke can also impair visibility along highways. This is especially true at night when the smoke settles to the ground and becomes denser, reducing visibility on the highway.

ACTIONS

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OBJECTIVE: Increase use of forest management practices, including prescribed fire, that create and maintain diverse forests.

DESCRIPTION

The control of forest fires in Wisconsin is a necessity given the juxtaposition of forests, people and property. The suppression of forest fires affects the composition, structure and function of forests by facilitating the conversion of non-forested land to forest. Prescribed fire is increasingly used as a tool to mimic the attributes of fire in maintaining some forest and non-forest ecosystems, including prairie, oak savanna and pine barrens.

Ecological Implications

Fire was a major presettlement disturbance factor in Wisconsin. It was particularly significant across much of southern Wisconsin, and on dry, sandy areas in the north. Fire dependent communities covered approximately 40-45% of Wisconsin's land surface in Pre-Columbian times. Native people used fire to manage natural communities, but the extent of impacts is uncertain. Fire type, intensity, and timing have a significant influence on the forest and wild land composition, structure, and function. Fire as a major disturbance factor has nearly been eliminated from the landscape. Natural succession governed by climate, site characteristics, species adaptations, and other types of disturbance is proceeding. Prairies and savannas depend on fire for their maintenance and renovation, and therefore have become rare in Wisconsin. Development and agriculture have claimed most prairies and savannas and to a lesser degree succession to forests has contributed to this problem.

Jack pine – scrub oak forests and barrens depend on fire for their maintenance and renovation. Large acreages of this cover type were converted to jack pine and red pine plantations following the early settlement cutover and fires. Now they are succeeding to white pine, red maple, and oak forests or converted to red pine plantations. Natural stands of red pine are fire dependent. Remnant stands do exist, but regeneration is lacking. Oaks, white birch, and aspen take advantage of conditions created by fires to regenerate and compete. These species currently are relatively common due to conditions created by the cutover and the fires that followed; however, there are regeneration concerns associated with each. Following the control of fire, significant changes in landscape structure have occurred. Open land has been developed or has succeeded to forestland, and the forests are developing some mid to late successional compositional and structural attributes. Functional processes have changed significantly following compositional and structural change and human development. Some plants and animals primarily associated with fire-dependent ecosystems are now rare. As fire dependent communities become rare, species abundance changes, and species richness may be reduced.

Economic Implications

Fire control is necessary in today's environment. It protects human life, property, and material resources. Natural resources associated with forests have higher market values than do natural resources associated with prairies, savannas, and barrens. Greater use of prescribed fire in forests and woodlands can result in decreased timber quality and value due to tree damage caused by fire.

Social Implications

Fire is mostly human-caused in Wisconsin, as humans encroach on the forested areas of the state, there is an increased risk factor for the ignition of forest fires. Control of fire protects human life and property. Human development in fire prone areas increases risks to human life and property, increases fire ignition potentials, increases fire protection exigencies, and limits forest management alternatives. There can be conflict between forest and prairie-savanna-barrens enthusiasts and users.

ACTIONS

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WARMING OF THE EARTH MAY AFFECT FOREST COMPOSITION, STRUCTURE, AND FUNCTION.

OBJECTIVE: Maintain and expand existing programs designed to address the possible effects of global warming and measure and document changes in forest composition, structure, and function as well as changes in other biotic communities.

DESCRIPTION

It is becoming increasingly clear that the earth is warming. However, there is disagreement about the long-term effects of this trend. Ecologists speculate that long-term global warming may result in a corresponding response in natural systems that could result in significant changes in forest composition, structure, and function.

Ecological Implications

As the earth's temperature warms, climate and weather patterns would likely change. Although average annual precipitation may increase, the form of this precipitation could be in intense storms, leading to more runoff and flooding. The rain patterns could also shift and occur more in the winter rather than the summer period. Periodic drought during the summer would likely occur. Other natural disturbance could increase, such as forest fires and wind events. Forests, dependent on moisture during the growing season, would adapt and ultimately change in composition. Species that are more resilient to drought, fire, and wind, such as the oaks and hickories, would likely become more prevalent replacing the more mesic hardwoods (maples, ashes, etc.). Likewise, the sand areas currently dominated by oaks and pines may dynamically convert to shrub and grass species as the dominant vegetation. Dieback of forest tree species would be gradual yet significant as species composition gradually changed. In general, there would be a significant shift in species ranges within the state. It is possible that growth rates for some forest types could greatly increase with additional warming and availability of increased carbon dioxide. In Wisconsin, these functional changes in our forests could result in dynamic changes in the acreage of forestland and certainly a change in forest types. The biological diversity associated with certain forest types, such as pine and mesic hardwoods, would likely decrease as these forest cover types decrease.

Economic Implications

With a potential change in forest cover there would certainly be an economic impact on the industries that rely on forests for raw material and the related consumer prices for forest products. Fiber would become limited in the temperate forest regions. Industries would likely shift to the available hardwood fiber thereby shifting the types of products created. Certain groups of species, like the mesic hardwoods, would likely increase in value due to a shortage of supply. Overall, the value of forestland would increase due to a decrease in the availability of forestland.

Social Implications

Social concern would be elevated due to an increase in catastrophic weather events, the loss of biodiversity, the change in forest composition, and the rising costs of certain forest products (paper, lumber, etc.).

ACTIONS

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OBJECTIVE: Encourage the understanding of forests in providing a carbon sink and encourage actions that preserve forests ability to function as a carbon sink.

DESCRIPTION

The pattern of land use in Wisconsin has a large impact on the emission of greenhouse gasses. The conversion of forests and farms to other uses results in the emission of carbon dioxide and other greenhouse gasses. Anthropogenic greenhouse gas emissions are believed to be a significant contributing factor to global warming. As trees and forests grow, they remove carbon dioxide from the air and release oxygen; as such, they represent an important carbon storehouse (or “sink”) that can contribute to the reduction of greenhouse gasses and global warming.

Ecological Implications

Forests are the most significant, expandable long-term reservoir for carbon. The potential to increase the storage of carbon is linked to the acreage of forests, the age of these forests, and the amount of harvesting or removal of trees as compared to new growth. In Wisconsin the forestland is increasing, the average age of forests is also increasing, and the amount of growth exceeds harvest. Forests can play a greater role as a sink in storing carbon if more lands are planted to forest, or if rotation lengths of existing forests are lengthened thereby storing more carbon per acre.

Economic Implications

Within Wisconsin, many incentives for managing forestland exist ranging from cost sharing programs to tax laws (i.e. Managed Forest Law). In time, forest landowners may be paid for storing carbon in their forests as a means to offset emissions of greenhouse gases. The concept of carbon credits, or a market based financial incentive for landowners to store carbon in their forests is developing. If rotation lengths for forest types are lengthened, possible economic implications include a scarcity of certain raw materials and a greater economic risk to landowners holding trees past a typical rotation age. The price for forest products may increase due to a limit on supply. Reduction in raw material availability may reduce employment and value added products in the forest products industry and subsequently in the rest of the economy through indirect and induced effects.

Social Implications

The social implications of global warming must include the development of a greater consumer ethic. This ethic must encourage a focus on the reduction of greenhouse gas emissions and a responsibility to address the effects of excess carbon. Forests are viewed as a desirable storehouse of carbon, possibly being the most easily recognized carbon pool. The public must closely examine the conversion of forestland to non-forest type use and forest harvesting levels. Land-use planning efforts must become a high priority for communities, as populations require additional growth and development.

ACTIONS

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PESTICIDES AND POLLUTANTS CAN THREATEN THE HEALTH OF ECOSYSTEMS.

OBJECTIVE: Identify and work to minimize the potentially negative impacts of pollutants and pesticides on all of Wisconsin's ecosystems.

DESCRIPTION

The indiscriminant use of pesticides in forest management can rapidly diminish the biological diversity of the site on which they are used. While certain pesticides like insecticides are rarely used in forest management, herbicides are commonly used to protect new tree plantations from weed competition. When pesticides are improperly used they can spread off the application site and into the air, surface water, and ground water. Other pollutants, such as ground level ozone, can negatively affect ecosystems at the local and regional scale.

Ecological Implications

Applications of broad-spectrum insecticides may kill many non-target insect species in the area sprayed. Bacteria-based insecticides such as *Bacillus thuringiensis* (Bt) kill a much smaller number of non-target species. Predators that feed on these non-target insects are required to search over a wider area or move their nesting sites. While the impact on non-target populations is sudden, the populations normally recover in one or two years. Herbicide may kill a wide or narrow spectrum of plant species depending on the product used. Plant diversity in the area sprayed is drastically reduced, and may not recover for many years. Broadcast applications can be more disruptive than narrow band applications. Site preparation with herbicide can reduce soil erosion when compared with traditional site preparation methods, such as tilling. Some herbicides are beneficial to endangered species by benefiting host plants, for example, those herbicides used to kill grass and sedge thereby releasing lupine, a host for Karner blue butterfly larvae. Misapplication of pesticides on very sandy soils or where fractured limestone is close to the surface can result in the pesticide polluting the ground water. Airborne pollutants such as ozone, SO₂ and NO₂ at high concentrations can damage foliage, acidify some soils and lead to reduction of pollution susceptible species such as white pine and quaking aspen.

Economic Implications

Herbicides are often used in forest management to avoid losses caused by invasive plants. Insecticides are rarely used in forest management but when they are used, it is to avoid catastrophic losses due to specific pests like gypsy moth. The cost of controlling these insects and invasive plants would be impossible or much more costly without pesticides.

Airborne and water born pollutants have had minimal impact on Wisconsin's forests. However, air pollutants occasionally cause reduced growth to sensitive tree species in localized areas.

Social Implications

While the potential for contaminating water wells exists, in Wisconsin, none are known to have been contaminated by pesticides applied in the course of forest management. Occasionally, airborne drift of herbicides causes damage to neighboring vegetation, which triggers complaints by landowners and investigation by government officials.

Pollutants have had minimal social impact on Wisconsin's forests. Airborne pollutants cause occasional damage to shade trees resulting in complaints by residential landowners.

ACTIONS

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OBJECTIVE: Educate the public about the important role forests play in protecting water resources, and support the reforestation of sensitive or erosion-prone areas.

DESCRIPTION

Forests are especially important in regulating surface and ground-water flow and quality. Riparian forests slow the movement of pollutants into water bodies, regulate water temperature, and provide food and habitat. The amount, location, and management of forest-lands within a watershed strongly influence the quantity and quality of water in streams, lakes, wetlands, and groundwater aquifers.

Ecological Implications

Forested land soaks up the majority of the rain that falls on it and this water supplies streamflow and recharges the groundwater supply, in addition to providing for tree growth. Since forested land generates virtually no runoff, it is a very desirable land use in terms of protecting water quality and reducing nonpoint source pollution. Nonpoint source pollution occurs when water from rain or snow flows overland and picks up particles of soil, sand or debris. All of these become pollutants when they are deposited into surface water. Nonpoint source pollution is the largest threat to water quality in Wisconsin, and the two biggest contributors are agricultural and urban sources. Sediment (soil or sand) in streams, lakes, and wetlands is the most common form of nonpoint source pollution. As sediment builds up in stream channels, it restricts flow and may redirect the flow of water, causing stream bank erosion. When too much sediment enters streams or lakes, it is harmful to fish as it buries their spawning beds, reduces what they can see (water becomes cloudy), and can even damage their gills. In addition, nutrients such as nitrogen and phosphorus that are attached to the sediment acts as fertilizer for undesirable aquatic vegetation like algae. Algae create more problems for fish because the decomposition of algae consumes oxygen from the water, which fish and other aquatic species need to live.

Economic Implications

The economic implications associated with water quality are enormous. It is very expensive and slow to clean up lakes and streams that have been impacted by nonpoint source pollution. It is much more affordable to keep water clean in the first place. The best way to keep surface water clean is by maintaining healthy forests on the land. Money invested in planting trees or improving forestland goes a lot farther than money invested to clean up water.

Social Implications

There are important social implications involved with this issue. As noted above, society needs to have clean water to drink and for recreational uses, like fishing and swimming. Forests are also very important for hiking, hunting, skiing, snowmobiling, etc.

ACTIONS

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SUCCESSION IS CHANGING FOREST COMPOSITION AND POTENTIAL FOREST PRODUCTS.

OBJECTIVE: Work to develop public consensus and encourage public involvement on the management of forest succession in Wisconsin.

DESCRIPTION

Wisconsin's forests are maturing; succeeding from an aspen-birch dominated composition to maple-basswood and other mid-to late-successional forest types. This change in species composition will have a major impact on the forest industry and the goods that it produces. The transition of Wisconsin's northern forests from early succession to late succession forest types is an important factor that will affect the forest industry in the future. This transition will cause the industry to adapt to use more soft hardwoods, such as red maple, for both pulpwood and sawlogs. Increase in tree size in the predominate species, such as maple, will accompany this transition to later successional forests, which will improve supply to sawmills. The southern forests in Wisconsin are predominately oak-hickory forest type and are transitioning to maple-basswood and elm-ash-soft maple types. In this part of the state, there may be a greater dependence on the production of pulpwood and a consolidation of sawmills due to a reduction of sawtimber supply from the southern broadleaf forest.

Ecological Implications

Wisconsin forests have historically been in constant successional change influenced by management and disturbance regimes. In Wisconsin, much of our forestland is succeeding to the maple-basswood type. Through management, we will be able to maintain the pioneer aspen-birch type on sites most appropriate for these species, but the acres will continue to decline. Aspen-birch forest type acreage in 1983 was 3.8 million acres and by 1996 had declined to 3.4 million acres. The Maple-basswood forest type acreage in 1983 was 4.1 million acres and increased by 1996 to 5.3 million acres. Wildlife species that prefer mid to late successional forests will benefit from this change while species preferring early successional forests will decline.

Economic Implications

This change in the resource will create some economic opportunities and reduce others. The forest industry historically has been very adaptable. If the forest resource is available at an economical price, the industry will make the capital investments needed to change. Not all industry will be adaptive, so some will cease to exist while

others will thrive. Much like a biological system, those that can adapt will continue, while those that choose not to adapt, will not. The important factor influencing the industry's ability to adapt is industry understanding of the time frame and how the resource is going to change, so they can plan for the future. The forest industry has grown from shipments of \$8 billion in 1982, to about \$19 billion in 1997. This growth has occurred with a changing resource and can continue to grow along with sustainable management of Wisconsin's forests.

Social Implications

The demand for wood products will not decline. We use about 70 cubic feet of wood per person per year in the United States. As population increases, demand increases. The social impacts in Wisconsin from a changing forest resource will be hardship in some communities where industry can not make the transition and increased economic well being in others that do make the transition. Forest industry jobs provide year-round support for service sector jobs and aid in the maintenance of the infrastructure needed by the tourism industry.

ACTIONS

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OBJECTIVE: Encourage forest management practices and the production of forest products that sustainably meet the needs of current generations while providing adequate resources to meet the needs of the future.

DESCRIPTION

There is increasing demand for wood and wood products globally, including the products that Wisconsin's forests provide. Paper, timber, furniture, crates—even syrup and wild mushrooms—are experiencing increased demand. This increase in demand can be met in a number of ways. Increased importation, increased production through forest management, shifting harvests to other states and/or countries, shifting harvest to other species, increased efficiency in production, recycling, reuse of products and shifting demand to non-forest products form the range of alternatives, all of which have environmental, economic, and social consequences.

Ecological Implications

Global demands for wood products are increasing. The increases in demand for wood follow very closely increases in global population. The industrial nations have 20% of the world's population and use approximately 80% of the wood products. Each person in the United States consumes about 70 cubic feet of wood per year in various wood products and it is estimated that the population in the United States doubles every 63 years. Average global production is 24 cubic feet per person. The goal of most developing nations is to develop to our standard of living. If this occurs a significant increase in wood product demand will occur. Current forest growth and removals is reasonably balanced in Wisconsin. There is some room for increasing the supply of soft and hard maple and reducing the supply of aspen and oak. Currently we are harvesting approximately 70% of net annual growth. Natural forest succession will result in a larger component of maple forest types throughout the state. Wood demand is global in nature and increases as population increases. These increases have been met in the past by increased harvest, capital investments to improve efficiency and some importation of round wood. Currently Wisconsin is roughly self-sufficient in its fiber needs. Our forests currently have the biological capability to supply 10 to 15% more fiber than is currently being used. With intensive management, this percentage could increase significantly. With reduced management and timber availability, timber supply could be constrained and exported to other areas of the world with less commitment to sound forest management.

Economic Implications

The steady increase in demand for wood will continue to drive forest product markets. Developing countries are using their forests more intensively and competing with U.S. companies. Companies in developing countries are quite competitive, even with higher logistical costs, due to limited environmental regulation and cheap labor in their countries. This competitive edge is further compounded by the

removal of timber resources from timber production in the U.S. based on social issues. Although demand will increase globally, we could see a reduction in demand for domestically produced products, due to the lack of competitiveness of domestic firms. Decreased domestic demand would result in the loss of jobs and a larger range of resource management alternatives. The estimated standing value of the timber harvested in 1996 was \$206 million. This timber was the basis for \$15 to \$19 billion in industrial output by the forest industries. The forest industry sector accounts for a little more than 3% of total state economic output. This sector also provides the stable industrial base that helps to maintain infrastructure needed by tourism industries in rural areas. Increasing demand will allow for expansion of the industry providing better opportunities to manipulate Wisconsin's forest for the desired goals, be it recreation, timber, or a combination. A change in policies reducing available timber supply would have the effect of exporting jobs to other areas.

Social Implications

The increased global demand for wood products could help to provide benefits to the citizens of Wisconsin in terms of jobs and recreational opportunities in the forests. This will occur if the industry is not excessively constrained by social decisions that reduce its productivity to the point that the industry can not compete in the market place. If this occurs, a loss of jobs and infrastructure also used by recreation industries could occur. The stability of the forest industry provides stability to the state economy, and therefore the societal needs of the citizens of Wisconsin. The increasing demand may create some social conflict over land use. Opportunities to meet increasing demand may be more seriously constrained as Wisconsin becomes more populated and forestlands become more fragmented, removing them from production.

ACTIONS

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DEMAND FOR FOREST-BASED RECREATION AND ASSOCIATED SERVICES IS INCREASING.

OBJECTIVE: Actively plan and manage for the future of Wisconsin's forests so that the needs of forest based recreationists can be met while sustainably managing our forest resource.

DESCRIPTION

More people are using Wisconsin's forests for a wider array of recreational activities which often requires more services to be provided by the forest owners or associated communities. Land managers who provide for recreation may see a changing clientele as well as more user conflicts. Providing some services such as RV campgrounds and motorized trails may preclude a more wilderness setting desired by other users. Other users may purchase their own forestlands to pursue their recreational activity. As recreationists demand more tourism-based services such as lodging, restaurants and retail stores, the opportunities and character of communities within Wisconsin's forests will change.

Ecological Implications

Recreationists seek the forest for its natural qualities but significant increases in use can result in degradation of those qualities to which the users were initially attracted. The potential negative impacts of more people using the same resource are wide ranging, including decreased game species (fish and wildlife), erosion on trails, disturbance of sensitive plants or animals, and new recreation facility development. Many large forest owners are selling small parcels to recreationists for vacation homes resulting in greater forest fragmentation and shoreline impacts. Secondary impacts on the resource such as pressure to develop more motels, restaurants or gas stations will result in fewer forest acres, increased fragmentation and loss of landscape-level ecological values.

Economic Implications

Increasing forest-based recreation has the potential for increased economic activity within the communities associated with the forests. These recreationists require a variety of tourism based services including lodging, food, fuel and retail stores. This increased service demand can help diversify local economies particularly in small northern forest areas. Jobs provided by tourism based services tend to be more seasonal, short term and lower paying in relation to jobs in manufacturing or forest products industries. The average tourism job earned about \$11,000 per year statewide while the average wood based industry job earned almost \$36,800 per year, with the state average being \$25,000 per year.

Social Implications

Increasing demand for forest based recreation can result in social implications among forest users and within local communities associated with the forests. Within the forests, more users of different types normally results in more frequent user-conflicts. Campers seeking rustic versus developed campgrounds and motorized recreation conflicting with wilderness seekers are examples of common conflicts. These conflicts challenge public land planning efforts. Within local communities, increased seasonal recreation demands often result in significant changes in community structure and character, required services (fire, police, etc.), property tax values, etc.

ACTIONS

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FORESTS ARE IN DEMAND FOR A MIX OF USES.

OBJECTIVE: Actively plan for Wisconsin's forests so that forests can be shared by multiple user groups while protecting the sustainability of our resources.

DESCRIPTION

The forests of Wisconsin, both public and private, provide a wide array of benefits to the residents of the state and beyond. Generation of forest products, protection of soil and water, habitat for rare species, consumptive and non-consumptive recreation, and wilderness and aesthetic settings are all services that forests can provide. As our population continues to grow the demand for all these services grows as well. The perception of people as to which values can be produced from the same resource base varies widely. For example, most hunters recognize how management for forest products also benefits game species habitat while wilderness advocates often state that both timber harvest and recreational development are incompatible with wilderness experiences. These variables create an increasing challenge for forest managers to provide these diverse services.

Ecological Implications

Forests are dynamic ecosystems that will change with or without human intervention. As our population increases a smaller land base of forest will be supporting a growing demand on its services. Decisions on which services the forest will support will determine its future ecological condition. Ecological services such as water and soil protection can be provided under a wide array of forest management practices. Decisions to manage for a forest products emphasis will generally favor early succession forest types such as aspen and pine and associated wildlife species. Management for wilderness will likely favor development of a forest of older successional forests such as maple and northern hardwoods and forest interior wildlife species. Forest management for recreation that is more intensive or residential activities may result in greater fragmentation and associated ecological impacts as well as increasing risk of wildfires.

Economic Implications

Northern Wisconsin communities closely associated with large forest areas depend on the economic benefits of forest product generation and tourism. Regional studies have shown that timber production and recreational use of forests are relatively compatible. Intensive recreation development, motorized use and hunting tend to be more compatible with timber production while silent sport and wilderness users are less compatible with active forest management. Recreationists require a variety of tourism-based services including lodging, food, fuel and retail stores. Jobs provided by tourism based services tend to be more seasonal, short term and lower paying in relation to jobs in manufacturing or forest products industries. The average tourism job earned almost \$11,000 per year while wood based indus-

tries statewide earned almost \$36,800 per year, with the state average across all job types being \$25,000 per year.

Social Implications

The uses of a forest have social implications among forest users and within local communities associated with the forests. With a forest, the amount and type of forest management will affect recreational users in different ways. Clearcutting benefit game species and hunting opportunities but reduce the aesthetic and wilderness settings. Increasing motorized recreation trails would attract new users to a forest but may negatively influence hiking, hunting, or cross-country skiing experiences. Within local communities, the uses of the forest will affect community structure and character, available jobs, required services (fire, police, etc.), and property tax values.

ACTIONS

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"GREEN" ACCOUNTING REPRESENTS A NEW WAY OF EVALUATING THE BENEFITS OF FORESTS.

OBJECTIVE: Educate the public and decision-makers about the full range of forest values, not just those with economic value.

DESCRIPTION

Some functions and services provided by forests are not considered in traditional economic accounting. For example, while most people value clean air and water, there has not been an accepted method of calculating the value of these environmental services provided by forests. The difficulty in accounting for these values can lead to underrating the economic value of forests. Likewise, there has not been a way to establish the value of forest aesthetics or other societal values. New research is developing ways to assign value to these aspects of forests (a concept called "green" accounting).

Ecological Implications

The forest provides a multitude of values beyond the forest products they produce. The nature of a forest as an ecosystem lends itself to wildlife habitat, water purification, water runoff, aesthetics etc. As these are not sold it is difficult to put a value on them. Efforts to value these non-market benefits may be irrelevant or even counter productive from an ecological perspective as discussed in the next section. Current forestry best management practices can produce non-market benefits at little cost as long as other income exists which will allow their provision.

Economic Implications

Placing an economic value on the non-market benefits produced by a forest is difficult. Researchers in social economics are trying to develop such valuation methods. A recent effort looked at landowner attitude and the value they placed on the non-consumptive use of their forest in relation to the standing timber value. There have been some attempts to use this information to show that the non-consumptive uses offer more value than consumptive uses. Such a comparison is questionable and can be counter productive. These non-market benefits generate no economic return to the forest landowner but do provide social benefits both to the landowner and society. In order to maintain non-market values in a market-based economy, a source of income is needed to maintain the forested landscapes required for their provision. As such, until markets develop for non-market benefits, the economic values of these benefits are debatable. The only way they will continue to be provided is through sources of income independent of their value. Green value accounting has the potential to illustrate the additional value associated with managing and deriving economic value from forestland, which allow them to remain intact. In 1996 in Wisconsin \$206 million in standing timber was sold. This timber produced \$15 to \$19 billion in economic output plus the full complement of non-market benefits.

Social Implications

Society values clean air, water, scenery and products, but placing a value on anything that is not traditionally sold is difficult. Often what people say that something is worth to them is quite different from what they are actually willing to pay. Yet, society is asking the managers of the forest resources to place a value on these uses in the planning process. Researchers are trying to develop methods that provide dollar value comparisons among these varied products and benefits. In a market-based economy, valuations of non-market benefits may be irrelevant. A better societal strategy would be to focus on policies, which allow these benefits to be produced at least cost while providing revenue from other activities to support their production.

ACTIONS

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SUSTAINABLE MANAGEMENT CERTIFICATION IS EMERGING AND THE GLOBAL MARKET FOR SUSTAINABLE FOREST PRODUCTS MAY GIVE CERTIFIED WISCONSIN FORESTS A STRATEGIC COMPETITIVE ADVANTAGE.

OBJECTIVE: Intensify cooperative efforts to enhance the sustainability of Wisconsin's forests through certification and other means that can contribute to protecting this resource and its benefits into the future.

DESCRIPTION

Wisconsin's forests have been increasing in volume for decades. To meet increasing global demand for wood products, sustainable forest management in Wisconsin forests has the potential to take some of the pressure off more at-risk forests in other areas of the world. Sustainable forest products produced in Wisconsin may be a good substitute for products made from wood harvested in tropical or boreal forests, where sustainable harvest is more difficult to maintain due to social needs or ecological characteristics. The forest products economy is a global one. High value veneer timber is likely to be shipped around the world, while wood for lumber and pulpwood is usually processed in the same region in which it grew. An outgrowth of the global marketplace has been the call for "green certification" of forest products. The stamp of certification is meant to assure the buyer that the product came from sustainably managed forestland. There is currently a wide range of certification systems, including Forest Stewardship Council, Sustainable Forestry Initiative, American Tree Farm, and International Standards Organization (ISO) 1400. Several Wisconsin forest products companies are choosing to become certified.

Ecological Implications

Within each certification process, a suite of sustainable "best management" forestry practices is developed. These forestry practices are to be implemented within the specific ownership that is certified or implemented on the property where raw materials are produced and purchased. The land base being "certified" is increasing under all of these programs. If these best management practices are either already in place or in time becomes the standard, the variety of ecological benefits will increase proportionally as best management practices are conditionally implemented. Wisconsin forestland increased by 640,000 acres between 1983 and 1996. Currently about 70% of net annual growth is harvested each year leaving 30% of the growth. The management practices encouraged by forest tax law incentives also encourage sustainable forest management. The long history of documented forest improvement in Wisconsin easily supports the premise that sustainable forestry is being practiced in Wisconsin. The amount of forest products certified as coming from forestland that is being sustainably managed is slightly increasing in Wisconsin.

Economic Implications

The world market place is demanding wood products that are produced in a sustainable manner. Wisconsin forest landowners and

forest industry have the potential to capitalize on this growing demand if a system to document and track sustainable wood product production can be developed that is cost effective for the small non-industrial private landowner. Sustainable wood products could provide a competitive advantage over the products produced in developing countries in a non-sustainable manner. Conceptually, a driving force behind green certification would be the demand by the consumer for green-certified products, with a premium price realized by the producer when a green certified product is available. To date this premium has not developed or is extremely rare. However, research shows that consumers do prefer green certified products vs. non-certified products if the price is the same. Market niche will expand if availability of certified products expands proportionally and the price of these products is competitive. If a trend develops towards certified products, it is possible that the only market for products will be green certified. Additional costs for certification fees and the documentation of sustainability are certainly a factor for the landowner. Certification businesses (i.e. consultants) will continue to grow if certification is profitable.

Social Implications

As certification processes continue to expand within the global economy, expectations will rise among consumers for forest management operations to seek certification. Transparent, third party procedures will be required in order to gain public trust. Competition for market niche may continue between the certification systems. Society is starting to place a value on products produced in a sustainable and environmentally friendly way. Historically, the more wealthy a nation, the more attention that nation's society will pay to the environment. This trend will favor a state like Wisconsin where forests were cut over and are now recovered and being managed in a sustainable way.

ACTIONS

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RECYCLING IS INCREASING.

OBJECTIVE: Continue to promote recycling in Wisconsin.

DESCRIPTION

Recycling of paper and wood products has increased dramatically over the last inventory period. Nationwide, between 1970 and 2000, recycling has increased from under 7% of total waste to about 30% of total waste. In weight, that increase has been even more dramatic, as our waste production has also increased significantly.

Ecological Implications

In Wisconsin, in 1998, the paper industry used about 2.5 million tons of recycled paper in the production of 5.3 million tons of paper. Paper demand tends to increase proportionally to increases in population. The increases in recycling have decreased the demand for pulpwood for paper by reducing the rate that this demand is growing. Recovered paper now provides more than 37% of the raw material fiber used at U.S. Mills, up from 25% in 1988. Recycled fiber has allowed Wisconsin forest industry to expand while leaving demand for Wisconsin timber relatively stable. Increased recycling has also reduced the amount of paper being landfilled. Recycling can not replace all of the fiber needs of the paper industry, as some new fiber needs to be used in making paper to achieve required strength properties. Recycled fiber can be recycled about 7 times before the fiber breaks down so fine that it is lost from the process.

Economic Implications

The economic impact of recycled fiber has allowed Wisconsin to continue the growth of the paper industry without exceeding the capability of the forest to supply their needs. Growth in this sector has helped keep the state's economy strong. These industries tend to limit the impacts of an economic downturn due to the global nature of their markets. This has also helped to reduce the amount and associated costs of paper products in landfills.

Social Implications

The impact of recycling has been to slow increasing demand for pulpwood for paper products and all of the benefits of reusing a product. The recycling effort is also extending the life of landfills in Wisconsin.

ACTIONS

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HARVESTED TREES ARE BEING USED MORE EFFICIENTLY.

OBJECTIVE: Continue to promote the efficient use of harvested wood.

DESCRIPTION

With improved technology for harvesting and milling, processing wood is now more efficient. More of the tree can be utilized at each step of the process, and new markets are being developed for wastes, such as saw dust, that once were discarded.

Ecological Implications

Technology in the processing of wood has been evolving to fit the ever-changing forest resource and society. Limited labor availability has driven the trend toward greater automation. Resource changes to smaller timber with more defects and global competition have driven the development of advanced processing equipment. This global competition includes competition with firms located in countries with labor costs a fraction of what the costs are here and less restrictive environmental regulations. Example technologies include thinner kerf sawing, computer optimization, computer controlled drying, self-leveling logging equipment, low ground compression equipment, etc. and pulping technologies that cause less air and water pollution and are more efficient and flexible. Environmental concerns and restrictions have also driven these investments. The forest industry has evolved into a very sophisticated and more environmentally friendly industry with a high degree of automation.

Economic Implications

The use of automated technology allows for more consistent decision-making resulting in better quality. These technologies also require less labor to operate. The reduction in the thickness of the saw can result in 1 to 3% more lumber recovery for every 1/32-inch the thickness of the saw is reduced. The high cost of the new technology has increased the competitiveness among large firms that can afford the technology, and in doing so a consolidation of the industry to fewer firms has been occurring.

Social Implications

The trend towards more efficient technology has reduced the number of smaller firms that exist. Some of the small family operations with fewer financial resources have closed, not being able to compete. More forest industry jobs are highly technical and provide a higher wage for the worker. The improved technology has allowed Wisconsin forests to support a growing forest industry with significant benefits to citizens in the form of jobs and recreational opportunities.

ACTIONS

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RIISING FORESTLAND PROPERTY TAXES ARE IMPACTING SHORT AND LONG TERM FOREST MANAGEMENT DECISION-MAKING.

OBJECTIVE: Cooperatively develop a long-term property tax strategy that will protect Wisconsin's forest resources and the myriad values they provide.

DESCRIPTION

Two factors, rising forestland values relative to other property and the Farmland Use Value Assessment Law, are redirecting a greater share of the state property tax burden to woodland. The demand for forestland for recreation, housing and investment purposes has resulted in assessed values doubling roughly every three years in recent trends reported by the Wisconsin Department of Revenue. Many landowners have experienced proportional increases in their tax bills. The Farmland Use Value Assessment program, fully implemented in 2000, has also had an effect of shifting tax burden to non-agricultural land, notably to private forestland.

Ecological Implications

There has been an alarming movement towards conversion of woodland to pasture or crops in order to take advantage of Farmland Use Value Assessment. This results in a loss of forestland and an increase in soil compaction and water quality problems related to grazing in forests. Accelerated parcelization and fragmentation, results in an ecological impact. Increased resource exploitation, including premature timber cutting, to generate income to pay taxes is another troubling possibility. Conversely, for some landowners, an increased interest in land management to care for an increasingly valuable asset may result.

Economic Implications

Increased enrollment of land under the Managed Forest Law, which has experienced a 75% increase in applications between 1998 and 2001, potentially results in a diminished tax base for local governments and exacerbates the tax burden of land not enrolled in tax incentive programs. Costs to the state for administration of the Managed Forest Law program are also increasing. The uncertainty of landowners whose long-term management decisions are put on hold over fear of rapidly rising taxes is another major concern. Other potential concerns include:

A long-term loss in the supply of forest products as productivity declines due to premature or destructive cutting on the part of some landowners.

A diminished supply of timber from landowners that decide the recreational and aesthetic value of woodland exceeds the value for products.

A increased demand for professional resource management advice from those landowners who recognize the importance of caring for an increasingly valuable asset.

Social Implications

There is a troubling trend towards parcelization of woodland to reduce tax liability. Other concerns include the increased rates of closure of land to public access and instability in traditional farmland ownership as farmers divest woodland to reduce overall tax liability.

ACTIONS

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OBJECTIVE: Encourage the continued use of purchase of development rights and acquisition of land to protect important forest lands from development.

DESCRIPTION

With changes in ownership of industrial lands and demographic changes in non-industrial private landowners, the amount of forested land open for public use is decreasing. Recently, large blocks of forested lands have transferred ownership not only between industry but also into government and non-industrial private ownership. This issue has implications for the future of public recreation. There are important ecological, economic, and social concerns as these large blocks of forest are sold, divided and potentially converted from forested lands to other uses. The ability of the State and the Counties, in concert with Land Trusts, to acquire some of these lands can be controversial when private ownership of forested tracts is in high demand.

Ecological Implications

Public acquisition or protection of large block of forested lands will result in less permanent fragmentation than if the lands were in private ownership. The size of forested parcels in private ownership has decreased in recent years. This leads to an increased density of roads, buildings and those changes in land use that result in permanent fragmentation. Wildlife habitat and species composition would also be impacted. Permanent fragmentation has a far greater impact on forested ecosystems than temporary habitat fragmentation, which may occur as a result of activities such as timber harvests.

Public ownership provides a greater opportunity to implement ecologically sustainable land management. Currently only 20% of private landowners employ the services of a professional forester when harvesting timber. Endangered and threatened resources would benefit from increased public ownership. Inventory and management of these resources is difficult on private lands and activities that negatively affect resources become more likely. Intolerant forest types such as aspen, birch and jack pine are declining. As private parcels get smaller, there is less likelihood that today's aesthetically-conscious landowners will manage for even-aged types.

Economic Implications

Wisconsin's forest industry is a national leader. The economic impact of the forest industry is significant when viewed from nation-wide, statewide, or county perspectives. The maintenance of a sustainable flow of raw forest products to industry will require sound forest management and public ownership promotes these practices. Additional forestry staff would be needed to manage any large increases in public lands. The current system of aids in lieu of taxes makes provisions to local units of government to compensate for public land ownership. However, public ownership would minimize future development possibilities that could potentially increase the

local tax base. Purchase of Development rights would minimize the perceived drawbacks of removing lands from property tax roles. Both fee simple public purchase of lands or the purchase of development rights would require a significant commitment of tax dollars.

Social Implications

Only 270,000 of the over 5 million state citizens own forestland. Public land ownership would ensure hunting, fishing and recreational opportunities are available for all citizens. Public purchase of additional private lands may deny some private individuals an opportunity to own their part of the landscape. Finally, the tourism industry is heavily dependent on an interconnected system of trails (fore example: snowmobile, hiking, biking, ATV, and horse.) Public ownership would facilitate the connectivity of the trails.

ACTIONS

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OBJECTIVE: Ensure timber harvesting is conducted in a sustainable manner and increase public acceptance of harvesting practices.

DESCRIPTION

The vast majority of loggers are professional business-people with a deep regard for and love of forests and the environment. They work with the state’s renewable resources on a daily basis and do their best to accomplish their work in a manner that avoids adverse environmental impacts. In response to concerns from resource managers and the public about poor logging practices performed by some loggers, leaders in the logging profession have responded by adopting training standards as a means of demonstrating the occupation’s professionalism.

Ecological Implications

The full range of products and benefits demanded by society from the forest cannot be maintained without the use of sustainable forest ecosystem management practices, which includes the harvesting of trees. The logger provides one of the tools used to manage the resource in an economical way. Poor logging can harm the environment and compromise the ability of the forest to provide the values desired by landowners and the public. Increasing professional standards will reduce the frequency of unintended adverse environmental impacts from logging.

Economic Implications

When the ethical, law-abiding logger has to compete with those who do not meet that criterion, a disincentive to log in a sustainable manner is created. As an example, when an ethical logger abides by all the law and tries to do what is environmentally and sustainably sound, he may have to compete with another logger who: 1) does not have workers’ compensation insurance for protection of his employees, 2) consistently trucks overweight loads or steals a load of wood here and there, and 3) has no concern over what he does to the forest or what his actions mean for future generations. The ethical logger obviously loses, but he is not alone; the landowner loses, forest industry loses, and the public in general loses. Certification would allow a distinction to be made between these two types of loggers and brought to public attention.

Social Implications

When poor practices are used by one logger, it reflects negatively on the logging industry and forest management as a whole. The logger who practices unethical methods also destroys public trust and in so doing reduces the management that occurs on private lands and hurts sustainable forestry as a whole. It can take many years to rebuild trust and reestablish sustainability on a family forest after a bad experience with a timber harvest.

ACTIONS

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MAINTAINING ADEQUATE SUPPLY OF HIGH QUALITY NURSERY SEEDLINGS FOR REFORESTATION AND CONSERVATION PURPOSES.

OBJECTIVE: Maintain an adequate supply of quality nursery seedlings for Wisconsin's conservation needs.

DESCRIPTION

Wisconsin has been considered a national leader in conservation and reforestation tree plantings since the Civilian Conservation Corps era of the 1930s. Millions of tree seedlings are planted each year in Wisconsin to create and enhance wildlife habitat, prevent soil erosion, conserve energy, provide aesthetic beauty, and provide the future raw material for the forest products industry. In Wisconsin, there are both public and private nurseries involved in the production and distribution of bareroot nursery stock for conservation plantings. Besides playing a vital role in the provision of adequate quantities of nursery stock, public and private nurseries also fill important roles as local employers and essential players in local and regional economies. While some would like to reduce the size of the state nursery program in favor of private nurseries, others argue that the program should be expanded to meet all of Wisconsin's need with little dependence on private nurseries.

Ecological Implications

Maintaining an adequate supply of high quality nursery seedlings is a critical component of sustainable forest management in Wisconsin. With a growing concern over the decrease of certain species represented in our forests, the importance of adequate nursery stock supplies has become increasingly important. Tree planting is often the most effective way to regenerate economically and ecologically important species, especially where natural seed sources are lacking. Concerns over global warming have also renewed interest in reforestation as a method to reduce greenhouse gases. In southern Wisconsin, hardwood tree planting has more than doubled over the past 15 years as highly erodible agricultural lands are reforested to prevent soil erosion and improve water quality. Increased knowledge of forest genetics has revealed the importance of carefully selecting seed sources to maintain the growth and adaptability of reforestation stock.

The state nursery program is currently providing only bareroot seedlings of native Wisconsin species, from appropriate seed sources, to landowners in Wisconsin for reforestation and restoration purposes. The state nurseries support a tree improvement program to develop genetically adapted and superior seed. Seedlings from the state nursery program can only be utilized for conservation plantings; they can not be utilized for ornamental, landscaping, or Christmas tree production. Private sector nurseries provide a much broader catalogue of species and plant sizes, including both native species and non-native varieties that are adapted to Wisconsin's growing conditions.

Economic Implications

The state nursery program currently produces and distributes between 18 and 21 million seedlings annually for reforestation of state, county, industrial, and private lands in Wisconsin. The private sector produces and distributes an estimated 3 to 5 million additional seedlings annually for conservation purposes.

The mission of the state nursery program is "to insure a consistent supply of high quality seedlings of desirable forest species, at an economical price, to encourage reforestation in Wisconsin." The state nursery program is required by state statute to be financially self-supporting from revenue generated by the sale of nursery stock. The purchaser of state nursery stock pays for the Department's entire cost of production, distribution, and administration of the state nursery program. Concern has been expressed by the private sector that the state's nurseries represent unfair competition due to their absence of a profit motive. In 2001, the legislature instituted a 3 cent per seedling surcharge to help compensate for lack of profit. The surcharge goes towards forestry education. The Department has stated that it will reduce state nursery production commensurate with increases in private sector production of quality native stock.

Social Implications

Thousands of Wisconsin landowners plant trees each year for conservation purposes, improving the state's environment and economy. The state nursery program has been a leader in the stewardship of Wisconsin's natural resources since 1911, producing over 1.4 billion seedlings for planting in Wisconsin. Partnerships and cooperative agreements between state, county, industry, and other private concerns have been built on the availability of high quality inexpensive seedlings, known seed sources, and genetically superior growing stock from the state nursery program. In addition, the state nurseries have contributed to the development of Wisconsin's forest industry by growing the type and quality of seedlings that provide the necessary fiber for future industrial use. The Department conservatively projects reforestation stock demand in Wisconsin to be 25+ million seedlings per year. At the present time, the gap between private sector capacity and public demand is very large, requiring both a strong public and private nursery system.

ACTIONS

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LARGE BLOCKS OF INDUSTRIAL FORESTLAND ARE CHANGING HANDS RAPIDLY.

OBJECTIVE: Initiate programs that minimize the fragmentation of industrial forestlands and protect public access to forestlands.

DESCRIPTION

In recent years, we have seen an increase in transfer of large blocks of forested lands between industrial companies, and in some notable cases, out of industrial ownership and into government or non-industrial private ownership. This trend may have important ecological, economic, and social implications for the future as these large forested land holdings are divided and, potentially, converted from forested lands to other land uses.

Ecological Implications

The large blocks of industrial forestlands, totaling more than one million acres in Wisconsin, provide important ecological benefits. They, together with adjacent public lands, provide contiguous blocks of forested habitat for a wide range of species. These lands also purify our water and sequester carbon.

Economic Implications

The industrial land base is an asset that encourages maintaining forest industry within Wisconsin. The forest products industry is the state's second largest, and Wisconsin leads the nation in paper production, value of shipments, and wages within the forest products sector. The industrial lands provide an important land base for a range of recreational activities, including hunting and snowmobiling, which contribute significantly to the local economy in the adjacent areas.

Social Implications

The amount of land open for public use is declining statewide, at the same time that demand for forest-based recreation is increasing. Almost all of the industrial lands are open to public use for a range of recreational activities, contributing to the quality of life in the areas within which these lands are located. Furthermore, the vast tracks of undeveloped land contribute to the rural character that attracts many to live, work and recreate in Northern and Central Wisconsin.

ACTIONS

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MORE PEOPLE ARE PURCHASING FORESTED LANDS.

OBJECTIVE: Initiate programs that minimize the fragmentation of forestlands caused by development effects and educate new forestland owners about sustainable forestry.

DESCRIPTION

The number of non-industrial private owners of forested land is increasing due to division of tracts into smaller parcels. Tract sizes across the Lake States, fueled in part by the value of forested land for recreational uses and home sites. Forest surveys estimate that the number of Wisconsin forest owners (about 270,000 in 1997) has approximately doubled over the last forty years. Parcelization of forests results in fragmentation - more roads, homes, yards, paths, etc.

Ecological Implications

As more people purchase ever-smaller parcels of forestland, it is reasonable to expect increased human impacts, such as the spreading of exotic or invasive species and increased runoff and soil erosion. Likely structural alterations in habitat including the creation of more edge will result in the loss of forest interior species that fall prey to or are displaced by edge dwellers, and isolation of species unable or unwilling to cross barriers. There is also a potential for increases in wildlife disease, including those that can be transmitted to humans.

Economic Implications

As more people purchase forestland it is likely that land values, and property tax assessments, will increase. Reduced economies of scale will make it harder to productively manage small tracts of timber, and as a result forest products may become more expensive. Local communities may be troubled by the increasing expense of providing services to a dispersed population, especially if jobs based on the production of forest commodities are threatened by a decreasing resource base.

Social Implications

As more people purchase and manage forestland, the community of forest landowners will grow and more people will enjoy the many benefits of forest ownership. There are, however, significant concerns about the loss of recreational opportunities as more land is posted no trespassing and the possible negative side effects of a growth in the number of non-resident landowners.

ACTIONS

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DESCRIPTION

As the number of non-industrial private forest landowners increases, providing professional forestry guidance to them becomes more difficult. Surveys estimate that only about 20% of landowners utilize assistance from professional foresters prior to harvesting timber and that 80% of woodland owners do not have a written forest management plan for their property. With over ten million acres of non-industrial, private forests in Wisconsin, the proper management of that land is critical to sustaining the resource for the many public benefits that come from it.

Ecological Implications

In the absence of professional guidance, destructive cutting practices may reduce the ability of the forest to renew itself. Consequently, wildlife habitat, endangered or threatened plants and animals, clean water and other environmental elements essential to a healthy ecosystem may be injured or left unimproved. Without adequate private forestry technical assistance, forest pests including insects and diseases are more likely to go uncontrolled and cause more damage. Land will recover more slowly from catastrophes such as wind storms or fires without a sufficient number of foresters to provide assistance to landowners. Lands retired from agricultural uses are less likely to be reforested or established in alternative natural vegetative cover. Finally, opportunities to improve grasslands and wetlands associated with the forested landscapes will be missed.

Economic Implications

If private forestry assistance continues to be inadequate, the forests of Wisconsin face several significant economic threats. The long-term productivity of land for both commercial and non-commodity benefits may be reduced. Landowners harvesting timber will be less likely to receive high returns for their products, and the supply of commercial forest products may decline- causing shortages and higher prices. Fewer landowners will benefit from forest tax or cost-sharing incentives if foresters are not available to administer the programs.

Social Implications

Landowners become frustrated if they cannot get professional resource management advice within a reasonable time. Without professional assistance, some landowners become hesitant to make any resource management decisions, while others will rush to inappropriate choices. If this were to happen, the recreational and aesthetic potentials of the landscape may not be realized or protected and fewer landowners would be able to appreciate the full ecological significance of their property.

ACTIONS

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THE DEMOGRAPHICS OF FOREST LANDOWNERS ARE CHANGING.

OBJECTIVE: Seek to educate forest landowners about the importance of forests and the need for forest practices that sustain forest resources.

DESCRIPTION

Today, forested parcels are likely to be purchased by people whose values differ from forest owners in the past. For example, forest surveys show that woodland owned by Wisconsin farmers declined from 6,372,000 acres in 1956 to only 1,467,750 acres in 1997. Rather than managing forests to supplement farm income, many current woodland owners are from urban areas and own forestland primarily for recreational or aesthetic values. Many tend to be hesitant about harvesting timber (especially using even-age techniques) or active management for any purpose. Others, however, are willing to implement practices that further their goals when they are persuaded through educational efforts.

Ecological Implications

If the average forest landowner chooses to harvest less often, or not to harvest at all, the composition of Wisconsin's forest will change markedly. Forest types, such as aspen, jack pine and oak stands, that require disturbance are likely to convert to shade tolerant species. Less active management could mean older, more crowded, forest stands. Wildlife species that thrive in disturbed habitats or young forests, such as ruffed grouse, may become less common. Finally, conifer plantations, which require periodic thinning to maintain optimum health, may decline if owners choose not to pursue active management.

Economic Implications

New forestland owners rate aesthetic values as one of their primary reasons for purchasing forested properties. Since even-aged management regimes are widely considered to be less aesthetically pleasing than other management techniques, it is possible that forest industries that depend on even-age forest types might experience a shortage of locally-produced raw materials. The changing demographics of forestland ownership may also lead to shorter average land tenure. However, as more people become interested in purchasing forestland, the average value of forested parcels will increase.

Social Implications

The changing demographics of forest landowners will result in a series of important social changes and considerations. New forest landowners may be unfamiliar with local institutions and traditions. A percentage of new forest landowners will come from more urbanized areas and may be sensitive to such issues as farming odors or timber cutting. Because many forested parcels are developed into second homes, there is a possibility that institutions that depend on local volunteers may experience difficulty finding help. Finally, if parcelization causes traditional farming and timber economies to change, local residents may be forced into new types of employment.

ACTIONS

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LESS FORESTLAND IS AVAILABLE FOR PUBLIC USE.

OBJECTIVE: Provide adequate amounts of forestland open to public use to meet the recreational needs of the people of Wisconsin.

DESCRIPTION

With changes in ownership of industrial lands and demographic changes in non-industrial private landowners, the amount of forested land open for public use is decreasing. This trend has implications for the future of public hunting, fishing and other forms of recreation.

Ecological Implications

An increased density of roads and buildings, along with other changes in land use stemming from an increasing number of landowners and smaller parcel sizes will lead to permanent forest fragmentation. Fragmentation will affect wildlife habitat and species composition. For instance, it is likely that interior-dependent songbird species will become more concentrated and dependent on large blocks of public land. As private lands are closed to hunting and trapping, they will experience higher concentrations of game species and the management of game species may become more problematic. Conversely, increased hunting pressure on limited public lands could negatively affect populations of some species and complicate management.

The aesthetic and environmental concerns of some recreationists may lead to a decrease in even-aged management along recreational corridors; which would discourage intolerant forest types such as aspen, birch, and jack pine that are already in decline statewide. Seasonal recreation use can limit timber harvest opportunities, directly influencing regeneration potential for some species. As motorized recreation becomes more prevalent, there is also an increased potential for erosion and ecological damage on public land.

Economic Implications

The income that the public sector has traditionally expected from forest harvests may decrease as public land is used more heavily for recreation and user conflicts with logging increase. Land managers will be challenged to provide opportunities for an ever-wider variety of uses and a greater number of users with limited space. It seems reasonable to assume that more staff and bigger budgets for public land will be needed to address increased usage.

Social Implications

The parcelization of industrial forestlands can sometimes break the continuity of recreational trails. This could mean an increasing need for new trails on public land to maintain existing levels of trail connectivity. Increased pressure on public lands may lead to degraded recreational experiences for user groups, including hunters, fishers, hikers, and skiers. With an increasing density of recreational users, conflicts amongst and between user groups can also be expected to increase. Changing forestland ownership patterns are also likely to increase conflict and controversy on land management activities such as timber harvesting. Since most new landowners post their property against trespassers, and public hunting on industrial forestland has gone on for many years, it is possible that rates of trespass will rise.

ACTIONS

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STAKEHOLDERS ARE MORE INVOLVED IN FOREST DECISIONS.

OBJECTIVE: Promote increased public dialogue about forestry issues.

DESCRIPTION

For a number of reasons, there is increased participation by a variety of stakeholders in decisions affecting forest policy and management of public lands. Various levels of government, local community groups, concerned industry groups, recreational users, property owners, and environmental groups are often a part of major decisions affecting Wisconsin's forests.

Ecological Implications

Stakeholders often bring information to discussions about issues. In some cases, this information pertains to the ecological aspects of the decision. This information helps inform the discussion and can influence decisions made.

Economic Implications

Many stakeholders are impacted directly or indirectly by the economic ramifications of decisions about the forest resource. Information about these implications often is not as readily available as ecological information. However, stakeholder involvement does ensure that economic aspects of sustainability are taken into account in decision-making.

Social Implications

By definition, stakeholders are in the best position to articulate many of the social implications of decisions about forests. Stakeholders reflect the range of values associated with our forests and decisions are improved by interactions among various stakeholders. Increased involvement in decisions about forests also increases the awareness and understanding of the public and other interest groups with respect to the full range of interests associated with forests. However, some stakeholders have expressed concern that there are too many issues for which public dialogue is desired, making it difficult for those who care about forests to adequately participate in such processes. In addition, processes take resources and time, from both participants and sponsoring agencies or groups.

ACTIONS

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CONFLICTING USE OF FORESTS IS A PUBLIC DEBATE.

OBJECTIVE: Explore strategies to minimize conflicts between forest user groups.

DESCRIPTION

Forests are used for recreation, to provide aesthetic beauty, to produce forest products, to maintain water quality, and to preserve wildlife habitat, among many other uses. Not all of these uses are always compatible in the same forest. The debate among people who value the forest for different reasons has grown in recent years. Some forest uses and some forest management techniques are controversial. This debate will continue to inform management decisions made in Wisconsin's communities.

Ecological Implications

Controversial management practices may be used more sparingly, affecting the long-term composition of Wisconsin forests. Reducing the use of even-aged management techniques such as clearcutting and shelterwood harvesting will, in the long-run, reduce the percentage of early and mid-successional forest types such as aspen, paper birch, jack pine, red pine, white pine, red oak and white oak. Increases will be seen in later successional (shade tolerant) forest types such as northern hardwoods; however, the species diversity within these types may be reduced if the techniques that bring more sunlight into the forest canopy are not used to some degree.

Economic Implications

Both forest products and forest-based recreation contribute significantly to local economies and the state's economy. To the extent that they are compatible, promoting both can maximize the economic benefits. However, the extent to which uses are incompatible – be they different types of recreational activities or recreation and forest management – limits to some extent where and how extensive economic benefits from the forests can be realized.

Social Implications

Conflict among users with different interests and values can create discord in communities and hamper decision-making. Desires to limit overlapping uses may be desirable and, in some cases, necessary; however, the result is that there are fewer areas available for these different uses.

ACTIONS

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CLEARCUTTING AND OTHER EVEN-AGE MANAGEMENT TECHNIQUES ARE CONTROVERSIAL.

OBJECTIVE: Invest in educational and consensus building processes that help balance the pros and cons of controversial forest management techniques such as clearcutting and other even-aged management techniques.

DESCRIPTION

Clearcutting is a timber harvesting process and a stand regeneration method that removes all trees from an area at the same time. This method typically encourages the regeneration and management of earlier successional species in forest types that have a uniform age. This even-age management technique, along with other techniques (such as seed tree and shelterwood regeneration methods), creates aesthetic and ecological changes to a forest. A variety of forest values (including aesthetic and ecological) benefit from this activity, while at the same time a variety of values are negatively affected. The trade-offs typically polarize advocates for specific forest values. Forest types that are favored with these techniques are pioneer to mid-successional types. Other disturbances (such as fire), either natural or human caused could be used to maintain these types. Fire has historically been suppressed or not used in forest management prescriptions due to public health and safety concerns or the lack of technical experience and resources. The use of even-age techniques and other disturbance oriented management tools (like prescribed fire) will continue to be an issue of conflict.

Ecological Implications

Terms like clearcut, even-aged management, selection system, and uneven-aged management often have different meanings to different people. Technical definitions can be confusing, misinterpreted, or considered irrelevant jargon. Lack of clarity or understanding of terms can result in increased conflict. Ecological implications of even-aged management are complex. Positive and negative impacts can occur at stand, landscape and regional levels. Conflicts arising from even-aged management often result from stand level activities and reactions to change (particularly the changed appearance of a recently harvested stand). However, ecological impacts are most significant at broader spatial scales – a result of cumulative effects of stand level activities.

Early to mid-successional forest tree species and cover types are adapted to disturbance and require it to regenerate. Fire historically was an important agent causing disturbances ranging from light and small to intense and large. Characteristics of other agents of disturbance have also changed, including insects, disease, animals, wind, and ice. New disturbance factors have been incorporated into the forest ecosystem, including climate change, pollution, exotic pests, land use conversion, human recreation, and logging. Disturbance regimes (type, timing, and intensity) have changed significantly in recent history. Consequently, relative abundance and distributions of forest cover types and successional stages have changed significantly, affecting other plants and animals that are part of these systems.

Economic Implications

Even-aged management is an efficient and cost-effective system to regenerate, to maximize growth, vigor, and to harvest most forest cover types. Uneven-aged management of early to mid successional cover types often will result in eventual type conversion, stand growth and vigor will be reduced, timber quality could be reduced, and operational logistics could be inefficient. Where maintenance of early to mid-successional species is an objective, even-aged management generally will be the most cost-effective means, and can provide the highest economic returns. For many people, even-aged management temporarily decreases the aesthetic quality of the forest. However, this has not been shown to reduce forest-based recreation and tourism. Frequently, even-aged management supports larger populations of popular game species, which does have a positive impact on recreation and tourism.

Social Implications

Even-aged management usually results in a dramatic change in the character of a forest stand that many people see as a significant decrease in aesthetic quality. Immediate reactions can be fierce, especially when impacted stands are located in areas of personal significance. Often, these concerns are abated as the forest regenerates and young trees gain height. Because of the dramatic change following even-aged harvests, misinterpretations of ecological impacts are common. Negative ecological impacts, like deforestation or destruction of wildlife and biodiversity, may be automatically and erroneously assumed. The ecological and economic impacts of even-aged management often are not understood.

ACTIONS

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OBJECTIVE: Invest in planning efforts and explore management techniques on public forests that provide the broadest range of benefits to the people of Wisconsin.

DESCRIPTION

As our growing populace places more extensive and diverse demands on our forests, the conflict is most acutely felt on the public forests. The federal, state, county and local forests have, to varying degrees, been subject to increasing conflicts between various interests and among various users. The role of public forests at different scales needs to be more clearly defined, and the implications of possible decisions made clear. Interest and use by the public of our public forests is primarily for recreation. Collective groups/organizations of taxpayers and municipal officials view the forest for its financial return values or lack of them. Land managers are often caught in the middle of producing forest products, maintaining wildlife habitat, protecting water quality and trying to satisfy the ever-increasing recreational demands. Managing conflicts between timber harvesting and recreational use is a primary issue facing public land managers. Conflicts between various recreational users are present as well.

Ecological Implications

Aesthetic-based viewpoints of our public forests discourage even-aged harvests. This is leading to a decrease in intolerant types such as aspen, birch and jack pine. We may also see an increase in all-aged, later successional species such as maple – basswood. Management for larger areas of old growth forests will increase in response to aesthetic and ecological concerns. Seasonal recreation use can limit timber harvests opportunities, directly influencing regeneration potential of some species.

Economic Implications

Reacting to public demands may lead to less timber cutting and consequently less timber income. It may also become harder to satisfy the increasing demands of society for forest products with current/increased acreage of public forest off limits to harvesting. There is also a strong possibility that a forest management shift away from harvesting on public lands could lead to local economies that move from a forest product-based economy to a more recreation / tourism- based economy.

Social Implications

There is a need for and an expectation of more trails. Consequently, it is possible that the increased numbers of participants will degrade the experience for some groups. Most recreational uses involve a certain level of conflict and/or compromise with other uses. For example, motorized recreation can lead to erosion, which has negative affects on water quality and forest aesthetics and wilderness preservation often means precluding use by groups that do not practice “quiet” recreation. Accommodating what are now some of the less popular recreational uses (such as horseback riding, snowshoeing, mountain biking) may enrich their respective sports. It is also possible that decreasing harvest levels may result in a short-term negative impact on the local citizens.

ACTIONS

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MOTORIZED RECREATION IS BECOMING MORE POPULAR.

OBJECTIVE: Further assess the implications of the increasing interest in motorized recreation, and plan to accommodate appropriate levels of motorized and non-motorized forest recreationists.

DESCRIPTION

Public and private forests provide for a variety of recreational activities including the use of snowmobiles, All Terrain Vehicles (ATVs), four-wheel drive trucks and dirt bikes. The number of motorized users in Wisconsin has increased dramatically in the last decade. For example, snowmobile registration has risen from 155,000 machines in 1991 to 257,000 in 2000 while ATV registration has risen from 60,000 in 1991 to 126,000 in 2000. Motorized users move faster, travel longer distances and require more land for their recreation than non-motorized users. Issues resulting from this increase in numbers include; insufficient trail opportunities, safety, greater law enforcement and land maintenance costs, conflicts with non-motorized users, and various environmental impacts (soil erosion, plant disturbance, water quality, etc.). Motorized users have also been shown to spend more money than most other recreationists and are viewed by some communities as an economic asset. Some large forest landowners are showing a trend toward restricting or eliminating motorized recreation opportunities.

Ecological Implications

Motorized recreation can take a variety of forms including winter or summer, trail-based, off-trail or cross-country travel, utility travel for another activity such as hunting, and intensive use or play areas. These different use types have varying potential ecological impacts including soil erosion, plant and wildlife disturbance, transport of non-native invasive species, noise and exhaust emissions. Depending on the design and level of use, winter trail based motorized recreation tends to have the least ecological impact. If motorized recreation continues to increase, these negative ecological impacts will be expected. These impacts can be reduced through proper trail planning, user education, increased law enforcement, increased maintenance and decreased densities on any given location.

Economic Implications

Many northern Wisconsin communities have recognized motorized recreation as a significant positive economic factor, particularly with national recognition of snowmobiling in Wisconsin. Some view motorized recreation as an opportunity to diversify local economies with new users who will spend money on services such as restaurants and motels. In areas where economies may be strongly based on the existing non-motorized recreational users, increasing motorized recreation may result in a decrease in the attraction to other users. Motorized users tend to spend more on their recreation than other outdoor users but have lower spending near their recreation site than other users. This is likely due to the high cost of their machines that are often purchased close to the user's place of residence.

Social Implications

Proposals to introduce motorized recreation into new areas or increase existing levels have consistently created conflicts with existing land uses. Established users have documented that the noise and potential ecological impacts of increased motorized recreation will negatively affect their recreation. Landowners adjacent to lands with motorized recreation also express concern over noise, dust and vandalism impacts. Some public and private land managers have expressed concern over impacts of motorized travel on their lands. Many motorized trails cross multiple ownerships creating a complex series of land use agreements required to support the trail. Generally, landowners are more willing to agree to winter use than summer use trails across farms or rural forestland.

ACTIONS

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MORE TRAILS ARE BEING CREATED AND USED.

OBJECTIVE: Further assess the implications of the creation of more trails and their increasing use, and plan to accommodate appropriate development and use.

DESCRIPTION

The demand for trail based recreation throughout Wisconsin continues to increase resulting in more trails on the landscape, a greater diversity of trail based activities and more frequent user conflicts. New or increasing trail uses result in demands for single use trails to become multi-use trails or for new trail development. Creation of new trails requires more land base, more cost for trail development and maintenance, and a greater need for cooperative planning among forest landowners. In some areas, trail opportunities are increasing through programs such as rails to trails. In other areas, opportunities are decreasing, for example, when large private forest landowners sell portions of their land base to multiple small owners.

Ecological Implications

Increased trail use and development will result in more people causing more impact to the forests that they have come to experience. Different use types have varying potential ecological impacts including soil erosion, plant and wildlife disturbance, transport of non-native invasive species, noise, dust and exhaust emissions. Examples of potential ecological impacts from different use types are varied; from erosion concerns on mountain bike or ATV trails to spread of invasive plant seeds by horses and from disturbance of wildlife by hikers to clearing for mechanized grooming of cross country ski trails. These impacts can be minimized through proper trail planning, user education, increased law enforcement, increased maintenance and decreased densities on any given location. Greater appreciation for ecological values through experiencing natural settings on a trail may result in long-term ecological benefits.

Economic Implications

Economic impacts from increased trail-based recreation can be local or statewide in scale. In local communities trail users require a variety of tourism-based services including lodging, food, fuel and retail stores. This increased service demand can help diversify local economies particularly in small northern forest areas. Jobs provided by tourism based services tend to be more seasonal, short term and lower paying compared with jobs in manufacturing or forest products industries. On a statewide scale, the increased demand for recreational products can have an economic impact through sales of items such as ATVs or mountain bikes. Motorized users tend to spend more on their recreation than other outdoor users but have lower spending near their recreation site than other users.

Social Implications

Increasing demand for trail-based recreation can result in social implications among forest users and within local communities associated with the forests. On the trails, more users of different types often results in more frequent conflicts among users. Very contentious issues arise when proposing new uses on an existing trail or a new trail that may change the character of a forest property. Examples of conflicts include motorized trail activities versus silent trail use or mountain bikes and horses sharing a trail. Some regional trails cross multiple ownerships, creating a complex series of land use agreements required to support the trail.

ACTIONS

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DEVELOPMENT IN FIRE PRONE AREAS.

OBJECTIVE: Strengthen levels of fire protection in fire-prone areas and educate the public about the threat of fire posed by the wildland-urban interface.

DESCRIPTION

As development continues to expand into forested areas of the state, there is an increasing forest fire risk, particularly in those parts of the state which have high forest fire potential. The absence of prolonged severe fire weather throughout the 1990s has the potential to embolden those who wish to develop in fire prone areas. The increased human presence in the wildland-urban interface presents a major challenge in protecting life, property, and the forest resource from destructive forest fires.

Ecological Implications

The areas of greatest concern in Wisconsin for forest fires affecting communities in the wildland-urban interface correlate with sandy soils and the jack pine/scrub oak forest cover type. It is in these forest cover types where historically the largest, most devastating forest fires have occurred in Wisconsin. Historically, severe drought cycles have been experienced in Wisconsin every 10 to 12 years. The ability to use prescribed fire as a management tool in these areas is controversial as development occurs within the forest.

Economic Implications

A large forest fire in Wisconsin that occurs in the jack pine/scrub oak forest cover type will greatly impact primary and secondary housing development in the area. Economic conditions since the mid-1980s have led to the fragmentation of the forest and individuals developing homes on these smaller parcels of land. The size and value of these homes built in the wildland-urban interface area have increased dramatically over the past decade. This increase in housing development has not always been made with proper planning for the protection of structures during forest fires. The economic loss associated with a major forest fire in Wisconsin will be much larger in scale due to the increased number of homes, their size, and their value.

Social Implications

With continued population growth, fragmentation of forestland and construction of primary and secondary homes in the forested area of the state, the wildland-urban interface area continues to expand in Wisconsin. It is primarily in this wildland-urban interface area that wildland fire causes structural losses to occur. Because more and more people like to live and recreate in forested areas, this will cause more structures to be imperiled by future forest fires. In addition, since humans cause a majority of forest fires in Wisconsin, more people living in the forested areas of the state will lead to a corresponding increase in the number of forest fires occurring in Wisconsin.

ACTIONS

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CONSUMPTION PATTERNS ARE NOT LINKED TO PRODUCTION.

OBJECTIVE: Implement outreach efforts to connect people with the impacts of their consumption behavior.

DESCRIPTION

Americans continue to increase their consumption of forest products, while at the same time many are calling for reducing the amount of forest land that is actively managed to produce those products. The disconnect between resource production and resource consumption is causing ecological, social and economic consequences in Wisconsin. These consequences include the shifting of harvest to different parts of the country and world, consumer decisions about product choices and land use choices.

Ecological Implications

With increasing global consumption of forest products, the extent to which we reduce production in Wisconsin results in increases in production elsewhere in United States and, more commonly, in other countries. Consequently, Wisconsin's forests may see an increase in later-successional forest types (e.g., northern hardwoods) and a decrease in early and mid-successional forest types (e.g., aspen, paper birch, jack pine, red pine, white pine and oak). The ecological impacts of this shift on forests elsewhere in the world depend on where the harvesting occurs and how it is conducted.

Economic Implications

To the extent that production is curtailed within Wisconsin, economic benefits provided by the forest products industry in Wisconsin will be reduced. The benefits will be enjoyed by economies located where the shift in production is transferred. The ability of local communities to facilitate the development of alternative economic opportunities would determine the long-term implications, locally and statewide.

Social Implications

The impacts will vary depending on where people live, work and play. To the extent that the forest products industry is a major economic force statewide, all citizens could be adversely affected if a significant shift out of Wisconsin occurs. Those who live in and/or recreate in the forest will assess the impacts differently, depending on their own values, the extent to which they are tied to the local economy, and how local communities adapt to any changes. More significantly, the consumption levels and patterns within Wisconsin and the other states are deeply rooted in society. Any efforts to reduce or even redirect consumption are likely to be met with significant resistance.

ACTIONS

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URBANIZATION IS INCREASING.

OBJECTIVE: Enhance urban forestry awareness and technical assistance.

DESCRIPTION

Wisconsin is becoming more urbanized, increasing demand for additional community green space, and putting use pressure on existing urban and nearby recreational green space. Communities are becoming more aware of the need to manage their urban forest and more are doing it; however, the pressure on limited resources to maintain other infrastructure is also increasing.

Ecological Implications

Forest land within and in close proximity to urbanizing areas is progressively lost to development. This reduces species diversity, habitat, soil quality and ground water recharge and increasing storm water runoff, non-point pollution, ambient air temperature, and surface ozone among other things. Forest land that is conserved within development frequently suffers degradation of ecological quality owing to introduction of exotic species, changed surface drainage, overuse and changes in use such as conversion to passive or active recreation. On the other hand, the ecological quality of the urban area itself improves because of the benefits provided by the remnant tree canopy. These benefits however are dependent on the extent, structure and quality of the tree canopy.

Economic Implications

High density development eliminates the forest products that could be harvested. Low density development, while maintaining much of the forestland, frequently eliminates harvesting as a management goal due to the values of the urban owner, again eliminating the economic contribution of forest products to an area's economy.

Desire to gain the greatest dollar value from a land investment through traditional development, both from the property owner and from local governments seeking to increase their tax base, discourages conservation of green space. However, non-traditional development, such as cluster housing, can increase total lot numbers and at the same time conserve a large degree of green space.

The remaining tree canopy in a newly urbanized area requires substantially more management by the property owner or local government to prevent it from becoming a liability. This is often not taken into consideration when calculating the cost of development. Development also creates other hidden strain on the infrastructure such as increased demand on roads, sewers, water supply, police and fire, schools, etc. All of these are in competition with urban forest management for limited tax dollars. Inadequate urban forest management will result in reduced property values further exacerbating development liabilities.

Social Implications

Society loses the benefits to air, water quality, recreation, species diversity and aesthetics that undisturbed forest cover provides. In addition to the loss of these benefits, failure to maintain high quality urban forest canopy reduces quality of life that can lead to people leaving the community, exacerbating further development on the urban/rural fringe.

ACTIONS

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DEVELOPMENT IS INCREASING.

OBJECTIVE: Enhance awareness efforts aimed at educating the general public, public officials, and developers about the need for growth and development planning that considers forests.

DESCRIPTION

Development continues to encroach upon forestland in Wisconsin. This trend is expanding the extent of urban forests while decreasing and fragmenting rural forests. People with urban attitudes and expectations are moving into rural areas and lakefront developments. This affects how the forest is used and influences the ecology of these areas.

Ecological Implications

The primary ecological implications for natural forestland are the same as those for forest fragmentation Issue . In addition, urbanites are more likely to manage forestland as a suburban landscape or park, which can affect species diversity, surface water quality and shorelines. For urban forests, development into native woodlands increases the extent and diversity of the overall forest beyond the traditional street, park and landscape trees. Greater canopy accentuates the ecological benefits urban trees provide – improved air and water quality, moderated ambient temperatures and storm water runoff, and expanded habitat and species diversity.

Economic Implications

Economic implications are identified in Forest Fragmentation issue for native woodlands and Urbanization Issue for urban forests.

Social Implications

The forest fragmentation issue and urbanization issue identify the social implications of this trend. In addition, urban attitudes and expectations tend toward preservation, esthetics and recreation and away from harvesting. This can lead to anti-harvesting legislation, despite an ever-increasing demand for forest products.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>



ABSENTEE LANDOWNERS AFFECT URBAN CANOPY.

OBJECTIVE: Initiate educational efforts regarding the value of the urban forest canopy in areas with a low rate of owner occupancy.

DESCRIPTION

There is less concern for urban land stewardship from absentee landowners and renters, so trees and other vegetation are not managed and not replaced as they die. This results in declining canopy in lower socioeconomic areas dominated by rental properties.

Ecological Implications

About 85% of a typical community is private property. Regardless of a local government's efforts on public property, the ecological benefits of the urban forest are greatly dependent on the character of private property. Declining canopy results in reduced species diversity, habitat, soil quality, air quality and ground water recharge, and increased storm water runoff, non-point pollution, ambient air temperature and surface ozone among other things.

Economic Implications

Reduced tree canopy reduces the economic benefits of the urban forest – increased property values, energy savings, business attraction, improved real estate rental, and increased retail sales - compounding the deterioration of low income neighborhoods.

Social Implications

Loss of urban forest reduces a neighborhood's sense of community and isolates residents by reducing the quality of common meeting and socializing space. The loss of trees not only degrades the beauty of a neighborhood directly, but also reduces the screening effect on deteriorating housing stock. All these in conjunction with the worsened environmental and economic conditions reduce the quality of life and encourage fleeing the area, exacerbating its decline.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>

CRITERIA AND INDICATORS FOR SUSTAINABLE FORESTRY ARE BEING DEVELOPED.

OBJECTIVE: Invest in inventory, monitoring, and analysis efforts to better document changes in ecological, economic, and social criteria and indicators.

DESCRIPTION

Wisconsin forest managers are joining other landowners across the country in meeting the commitment the U.S. made as part of the Earth Summit, to practice sustainable forestry. Accomplishing this requires the development of criteria and indicators that we can use to gauge progress. Sustainability criteria are being developed for rural Lake States forests as well as for urban forests.

Ecological Implications

The sustainable forestry criteria developed for ecological implications include 2 major categories: 1) the Maintenance of Biological Resources (elements of this criteria include diversity of forest communities, species diversity, genetic diversity, productive capacity of forest sites, forest structure, forest composition and forest function) and 2) the Maintenance of Soil, Water and Air quality (elements of this criteria are water quality soil quality, and air quality). Numerous indicators are identified for each of the criteria and associated elements. A geographic scale has also been introduced to the process of measurement, ranging from state or province to county or forest management unit to the woodlot scale. These indicators may or may not be appropriate measures for any particular scale. The ecological implications for implementing a system of criteria and indicators are that much management effort will be placed on the actual process of measurement, analysis of data, and adaptation of management actions, as needed. Adapting management to new information will become a very normal procedure. In addition, where some indicators are easily measured (for example acres of forest), other indicators are much more complex (ex. biodiversity). Expertise will need to be available to develop these measurement systems. Ecological benefits should be realized because management will change to address concerns.

Economic Implications

The sustainable forestry criteria developed for economic implications include the Provision of Multiple Economic Benefits (elements of the criteria include competitiveness of forest-based industries, community vitality, and goods and services produced). As stated earlier in the ecological implications, geographic scale has also been introduced to the process of measurement, ranging from state or province to county or forest management unit to the woodlot scale. These indicators may or may not be appropriate measures for any particular scale for specific economic indicators. A shift in resource personnel or skills will be needed in agencies to foster monitoring expertise for each of the criteria. Practical economic considerations include measuring the variety of ecological, economic and social criteria and indicators which will require spending resources on

inventory, monitoring and analysis efforts by agencies and resource managers. By addressing ecological concerns through management, healthier forest systems should develop ecological benefits, which ultimately relates to healthy, sustainable economies.

Social Implications

The sustainable forestry criteria developed for social implications include the Maintenance of Community and Cultural Values (elements of this criteria include historical and cultural values, affordability of forestland, personal and spiritual values, and owner responsibility). The social implications include developing a social acceptance and understanding that resource management includes a greater emphasis on monitoring efforts for ecological, economic and social criteria. Likewise, developing measures of values, such as spiritual, personal, cultural, etc., is very difficult. Approaches used in measuring these criteria vary greatly and one value may not necessarily equate to another on an equal basis. Gathering information and using this information in decision-making will be important for successful integration efforts.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>

PUBLIC OUTREACH AND EDUCATION ABOUT FORESTRY SHOULD BE AUGMENTED.

OBJECTIVE: Invest in improving the effectiveness of public education and outreach efforts to better facilitate public involvement in decision-making about Wisconsin's forest resources.

DESCRIPTION

Every Wisconsin citizen and visitor depends upon forest resources for shelter, wood products such as furniture and paper, and for cleaner air and water. Most everyone enjoys the beauty of trees and forests, whether in an urban or rural setting. In addition, many Wisconsin citizens depend upon forests or the manufacture of forest products for their livelihood. Despite this widespread dependence on forests and forest products, many Wisconsin citizens and visitors believe that it is wrong to harvest trees, and they do not know that forests can be sustainably managed to balance ecological, social, and economic needs and values for present and future generations. Current forestry public outreach and education efforts are insufficient to foster an appreciation for the value of forests in everyone's lives and the benefits of sustainable forestry for the public now and in the future.

Ecological Implications

Many Wisconsin citizens and visitors, particularly those with urban backgrounds, have little understanding of the basics of forest ecology or the ecological benefits of trees and forests for the air, water, soil, plants, and animals of the state.

Economic Implications

Many Wisconsin citizens and visitors have little understanding of the major role that forest and forest products play in Wisconsin's economy.

Social Implications

All Wisconsin citizens and visitors consume and use wood in many ways every day, yet many believe that harvesting trees is wrong. They do not understand that wood is a renewable resource and that forests can be managed sustainably. Negative public opinion about forestry practices and professionals is generally based on misunderstanding and stereotypes.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>



THE EFFECTS OF GLOBAL POPULATION GROWTH.

OBJECTIVE: Raise awareness about the possible impacts of population increases on forests and demand for forest products.

DESCRIPTION

While seldom considered by forest resource managers, human population growth will probably exert a subtle influence over many of their actions. Moreover, because population growth is gradual, it will be difficult to assess the impact it has on the use of forests from the standpoint of a relatively short planning horizon (10-20 years). Still, because many management decisions are based on long periods (>50 years), a substantially larger future population must be assumed when predicting the decision outcomes. The population of Wisconsin increased by 9.6% between 1990 and 2000, less than the nationwide increase of 13.1%. However, Wisconsin's forests will feel the impact of growing numbers of recreationists and property owners from outside of the state as well as wood products consumers from around the globe.

Ecological Implications

The trend toward increasing permanent forest fragmentation and declining populations of forest interior species may continue due to possible growth in the number of housing units in forests. Larger numbers of people recreating and building homes in forests may hamper the survival of some forest mammals, such as timber wolves and bobcats, which have ranges that depend on large tracts of forest with low human interference.

Economic Implications

The demand for forest products will increase. Consequently, forest management and capital investment in forest operations may intensify. Recreational use of forests will increase and fuel the growth of the tourist-based service sector in forested regions. The acreage available for harvesting timber and pulpwood may shrink due to the following:

- More residences built in forests may exclude harvesting due to aesthetic objections of property owners.

- More recreationists visiting forests may increase public pressure to restrict harvesting on public lands.

- Private parcels (<20 acres) that are too small for viable commercial logging will account for a larger area of the forest resource statewide.

- These factors may contribute to the need to intensify management on a smaller land base to satisfy consumer demand.

Social Implications

The parcelization of forestland will increase, increasing the amount of forest and belonging to small, private ownerships. An increase in the number of small, private forestland owners could boost demand for private forestry assistance from DNR Forestry and private consultants. The likely increase in the number of recreationists on public lands could intensify conflicts between different user groups. Trail use will increase, intensifying conflicts on existing trails and creating demand for additional ones.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>



INTEGRATION WITH OTHER AGENCIES AND DISCIPLINES.

OBJECTIVE: Promote collaboration within the full range of agencies, interest groups, and disciplines involved in forestry.

DESCRIPTION

By definition, foresters manage systems – forest ecosystems. However, not all the applicable expertise resides in the forestry profession or within the Department of Natural Resources. To achieve the goal of protecting and sustainably managing Wisconsin's forests many disciplines and many public and private partners need to work together.

Ecological, Economic, and Social Implications

Bringing together a full range of disciplines germane to sustainably managing forests, and the agencies that can facilitate its application, can help identify and assess the full range of impacts on forests of pursuing various management options, and facilitate the implementation of appropriate activities. Consequently, decisions will reflect a more robust assessment of important issues and concerns across all three "legs" of sustainability – ecological, economic and social.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>

THE CULTURAL VALUES OF FORESTS CAN BE HARD TO QUANTIFY AND MAY BE UNDERESTIMATED.

OBJECTIVE: Work to better understand and consider the cultural values of Wisconsin's forests.

DESCRIPTION

People value forests for a wide array of benefits. Some of these benefits are utilitarian and others are often defined as intrinsic, i.e., values unrelated to direct human benefit. Examples cited include the person who values wilderness although they do not intend to ever visit a wilderness area, and the spiritual values of forests. Although these might both be strictly defined as human-based value, they are nonetheless often viewed as “nontraditional” values of forests. There are widely ranging opinions about the relative importance of intrinsic values, probably due to different value paradigms of those in debates about forests.

Ecological Implications

It can be argued that at least part of the reason people advocate the existence of all species is for intrinsic reasons, not simply because they may directly benefit humans. To the extent intrinsic values affect decisions regarding management of land they will have ecological implications. The specific implications will vary depending on the value and its manifestation (e.g., species or condition). It seems that intrinsic values are most often used to advocate less human intervention in forests. Therefore, placing a high degree of emphasis on intrinsic values might lead to less human-based disturbance in forests, favoring later successional forest types over early and mid-successional forest types.

Economic Implications

The specific implications will vary depending on the value and its manifestation (e.g., species or condition). It seems that intrinsic values are most often used to advocate less human intervention in forests. As a result, placing a high degree of emphasis on intrinsic values might lead to reductions in certain economic benefits, including forest products and at least some types of forest-based recreation.

Social Implications

Intrinsic values, like utilitarian values, reflect society's desire to receive benefits from forests. Consequently, consideration of the full range of forest values will improve decision-making. Given the wide range of value placed by individuals on aspects of forests that might be termed “intrinsic”, dialogues about these values are likely to remain contentious.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>

OBJECTIVE: Explore opportunities to expand the use of wood biomass for the production of energy in the state.

DESCRIPTION

Cost-effective and environmentally sound energy production is an increasingly important issue nationwide, as well as here in Wisconsin. Increasing costs of fossil fuels, technological developments in the biomass energy industry, and the public's desire for the clean production of energy have led to interest in expanding the use of renewable forms of energy, such as wood biomass. The production of energy from wood biomass, which today occurs on a limited scale in Wisconsin, may have the potential to be win-win opportunities for communities, businesses, and the environment.

Ecological Implications

Unlike fossil fuels, wood is a *renewable resource* that can lead to a sustainable and dependable supply of energy. This in itself is a major advantage of wood biomass over natural gas, oil, propane, and other forms of fossil fuels. Additional ecological considerations include:

Carbon Emission: Wood combustion results in little net production (only about 5-10%) of carbon dioxide (CO₂), one of the greenhouse gases of greatest concern. The CO₂ generated during the combustion of wood equals the CO₂ consumed during the life cycle of the tree. However, some of the advantages of a limited net production of CO₂ can be reduced by the CO₂ produced through the transportation of wood to energy production facilities.

Metals, Sulfur, and Ash: Wood contains little heavy metals and sulfur, and thus the contribution of its combustion to acid rain pollution is minimal. In addition, particulate emissions can be controlled through standard emission control devices.

Accumulation of Woody Debris and Residue: Facilities that convert wood biomass to energy can help dispose of logging and forest products industry residues. Additionally, such facilities can provide an economic incentive to address the accumulation of large woody debris and increased density of small-diameter trees on forests in the state—material that can contribute to the risk of forest fires and threaten species diversity.

Economic Implications

The primary economic advantage of using wood biomass to produce energy is that wood fuel is usually *less expensive* than competing fossil fuels. The cost of transporting wood biomass to an appropriate power facility is the main cost of using wood biomass for energy production, and it can vary tremendously depending on the distances between biomass supplies and wood power plants. Probably the greatest economic disadvantage of wood energy technologies is the high initial cost of building and setting up a wood biomass energy system,

which generally costs about 50% more than initial costs for fossil fuel systems.

Social Implications

Wood biomass facilities can offer a chance to diversify the economy in local communities. Many people place high value on the success of small businesses that hire local people and invest in local communities. Locally owned, small wood biomass facilities can help to provide this value.

ACTIONS

A list of possible actions to address this objective is included in the electronic version of the plan. These possible actions, which were gathered as part of the final public-review process, are not printed here because they are not formally part of the final plan. However, these possible actions provide a springboard for implementation and are forwarded to the process for developing the implementation plan. You can view the actions for this objective at <http://dnr.wi.gov/org/land/forestry/look/assessment/>

APPENDIXES

Summary of the Trends and Issues Wisconsin Forests Face

The following trends and issues were identified in the November 2000 *Wisconsin Forests at the Millennium Assessment* and during the public input phase of the planning process.

1. Trend: Wisconsin's forests are aging and forest succession is occurring.
2. Trend: Forestland is increasing
3. Issue: Some tree species are declining.
4. Trend: There is limited oak regeneration in southern Wisconsin.
5. Issue: Information about biodiversity is scarce.
6. Issue: It is a challenge to make scientific information relevant to decision-making.
7. Trend: The list of threatened and endangered species is growing.
8. Issue: Invasive exotic species are an increasing threat.
9. Issue: Some biotic communities and important development stages of biotic communities are rare.
10. Trend: Forest disturbance patterns are changing.
11. Issue: Stands of old forest are rare.
12. Issue: The forest is becoming more fragmented.
13. Trend: Average acreage burned by forest fires has declined.
14. Issue: Control of fire affects forest composition
15. Trend: Warming of the earth may affect forest composition, structure, and function.
16. Issue: Forests affect carbon emissions and sinks.
17. Issue: Pesticides and pollutants can threaten the health of ecosystems.
18. Issue: Forests contribute to the protection of water resources.
19. Issue: Succession is changing forest composition and potential forest products.
20. Trend/Issue: Global demand for forest products is increasing.
21. Trend/Issue: Demand for forest-based recreation and associated services is increasing.
22. Trend/Issue: Forests are in demand for a mix of uses
23. Issue: "Green" accounting represents a new way of evaluating the benefits of forests.
24. Issue: Sustainable management certification is emerging and the global market for sustainable forest products may give certified Wisconsin forests a strategic competitive advantage.
25. Trend: Recycling is increasing.
26. Trend: Harvested trees are being used more efficiently
27. Issue: Rising forestland property taxes are impacting short and long term forest management decision-making.
28. Issue: Land trusts and state and county land purchases.
29. Issue: Logger certification.
30. Issue: Maintaining adequate supply of high quality nursery seedlings for reforestation and conservation purposes.
31. Trend: Large blocks of industrial forestland are changing hands rapidly.
32. Trend: More people are purchasing forested lands.
33. Issue: More private forestry assistance is needed.
34. Trend: The demographics of forest landowners are changing.
35. Trend/ Issue: Less forestland is available for public use.
36. Trend/Issue: Stakeholders are more involved in forest decisions.
37. Trend/Issue: Conflicting use of forests is a public debate.
38. Issue: Clearcutting and other even-age management techniques are controversial.
39. Issue: Role of public forests.
40. Trend/Issue: Motorized recreation is becoming more popular.
41. Trend/Issue: More trails are being created and used.
42. Trend/Issue: Development in fire prone areas.
43. Trend/Issue: Consumption patterns are not linked to production.
44. Trend: Urbanization is increasing.
45. Trend/Issue: Development is increasing.
46. Trend/Issue: Absentee landowners affect urban canopy.
47. Issue: Criteria and indicators for sustainable forestry are being developed.
48. Issue: Public outreach and education about forestry should be augmented.
49. Trend: The effects of global population growth.
50. Trend / Issue: Integration with other agencies and disciplines.
51. Issue: The cultural values of forests can be hard to quantify and may be underestimated.
52. Issue: Wood biomass for energy production.

Summary of Objectives

1. Promote continuation of a landscape mix of forests that represent a full array of forest types, age classes and successional stages.
2. Encourage additional increases in forestland where appropriate as determined by ecological, economic, and society's needs and values.
3. Encourage the maintenance of native tree species within forests and the presence of forest types that are becoming uncommon.
4. Encourage the maintenance of oak within forests and the oak forest type.
5. Conserve, protect, and manage for biological diversity and support continuing research on biological and ecosystem diversity.
6. Develop tools and strategies for improving the transmission of forest science information to the public.
7. Protect threatened and endangered species and support inventory and research on biological and ecosystem diversity.
8. Work to minimize invasive species introductions and mitigate the impact of those introduced on all forestlands.
9. Protect rare ecosystems and support continuing inventory and research on biological and ecosystem diversity.
10. Manage for healthy vigorous forests that are more tolerant of insect outbreaks and disease and human related impacts.
11. Conserve, protect, and manage old growth forests and, where feasible, encourage their appropriate representation on the variety of ownerships.
12. Work to minimize forest fragmentation and explore techniques that would allow fragmented forests to retain a larger portion of their original ecological, economic, and social benefits.
13. Monitor and assess the growing wildland-urban interface and continue to support forest fire prevention efforts and public education campaigns designed to minimize the threat of uncontrolled wild fires.
14. Increase use of forest management practices, including prescribed fire, that create and maintain diverse forests.
15. Maintain and expand existing programs designed to address the possible effects of global warming and measure and document changes in forest composition, structure, and function as well as changes in other biotic communities.
16. Encourage the understanding of forests in providing a carbon sink and encourage actions that preserve forests ability to function as a carbon sink.
17. Identify and work to minimize the potentially negative impacts of pollutants and pesticides on all of Wisconsin's ecosystems.
18. Educate the public about the important role played by forests in protecting water resources and support the reforestation of sensitive or erosion-prone areas.
19. Work to develop public consensus and encourage public involvement on the management of forest succession in Wisconsin.
20. Encourage forest management practices and the production of forest products that sustainably meet the needs of current generations while providing adequate resources to meet the needs of the future.
21. Actively plan for the future of Wisconsin's forests so that the needs of forest-based recreationists can be met while protecting the sustainability of our forest resource.
22. Actively plan for Wisconsin's forests so that forests can be shared by multiple user groups while protecting the sustainability of our resources.
23. Educate the public and decision-makers about the full range of forest values, not just those with economic value.
24. Intensify cooperative efforts to enhance the sustainability of Wisconsin's forests through forest certification and other means that contribute to protecting this resource and its benefits into the future.
25. Continue to promote recycling in Wisconsin.
26. Continue to promote the efficient use of harvested wood.
27. Cooperatively develop a long-term property tax strategy that will protect Wisconsin's forest resources and the myriad values they provide.
28. Encourage the continued use of purchase of development rights and acquisition of land to protect important forestlands from development.
29. Ensure timber harvesting is conducted in a sustainable manner and increase public acceptance of harvesting practices.
30. Maintain adequate supply of quality nursery seedlings for Wisconsin's conservation needs.
31. Initiate programs that minimize the fragmentation of industrial forestlands and protect public access to forestlands.
32. Initiate programs that minimize the fragmentation of forestlands caused by development effects and educate new forest landowners about sustainable forestry.
33. Provide increased forestry assistance to forest landowners.
34. Seek to educate forest landowners about the importance of forests and the need for forest practices that sustain forest resources.
35. Provide adequate amounts of forestland open to public use to meet the recreational needs of the people of Wisconsin.
36. Promote increased public dialogue about forestry issues.
37. Explore strategies to minimize conflicts between forest user groups.
38. Invest in education and consensus building processes that help balance the pros and cons of controversial forest management techniques such as clear cutting and other management techniques.
39. Invest in planning efforts and explore management techniques on public forests that provide the broadest range of benefits to the people of Wisconsin.
40. Further assess the implications of the increasing interest in motorized recreation, and plan to accommodate appropriate levels of motorized and non-motorized forest recreationists.
41. Further assess the implications of the creation of more trails and their increasing use, and plan to accommodate appropriate development and use.
42. Strengthen levels of fire protection in fire-prone areas and educate the public about the threat of fire posed by the wildland-urban interface.
43. Implement outreach efforts to connect people with the impacts of their consumption behavior.
44. Enhance urban forestry awareness and technical assistance.
45. Enhance awareness efforts aimed at educating the general public, public officials, and developers about the need for growth and development planning that considers forests.

46. Initiate educational and incentive programs aimed at improving the quality of the urban canopy in areas with a low rate of owner occupancy.
47. Invest in inventory, monitoring, and analysis efforts to better document changes in ecological, economic, and social criteria and indicators.
48. Invest in improving the effectiveness of public education and outreach efforts to better facilitate public involvement in decision-making about Wisconsin's forest resources.
49. Raise awareness about the possible impacts of population increase on forests and demand for forest products.
50. Promote collaboration within the full range of agencies, interest groups, and disciplines involved in forestry.
51. Work to better understand and consider the cultural and intrinsic values of Wisconsin's forests.
52. Explore opportunities to expand the use of wood biomass for the production of energy in the state.

Criteria and Indicators for Sustainable Forestry

In an attempt to better quantify what sustainable forestry means and assess our progress in achieving sustainability, in 1993 twelve countries — including the United States — joined together in Montreal, Canada to discuss how sustainable forestry might be defined and potentially measured in terms of outcomes. The product of that meeting is referred to as the “Montreal Process.” The Montreal Process identifies a framework of criteria and indicators for tracking progress in forest sustainability. This framework of criteria and indicators can be used to foster discussions on the progress of achieving forest sustainability. The elements of Wisconsin’s statewide forest plan can be linked to these criteria and indicators to allow us to participate in a more global assessment of progress in sustainable forestry.

Montreal Process Criteria and Indicators

CRITERION 1: CONSERVATION OF BIOLOGICAL DIVERSITY

- Indicator 1*
Extent of area by forest type relative to total forest area.
.....
- Indicator 2*
Extent of area by forest type and by age class or successional stage.
.....
- Indicator 3*
Extent of area by forest type in protected area categories as defined by IUCN or other classification systems.
.....
- Indicator 4*
Extent of area by forest type in protected areas defined by age class or successional stage.
.....
- Indicator 5*
Fragmentation of forest types.
.....
- Indicator 6*
Number of forest dependent species.
.....
- Indicator 7*
Status (threatened, rare, vulnerable, endangered, or extinct) of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment.
.....
- Indicator 8*
Number of forest dependent species that occupy a small portion of their former range.
.....
- Indicator 9*
Population levels of representative species from diverse habitats monitored across their range.

CRITERION 2: MAINTENANCE OF PRODUCTIVE CAPACITY OF FOREST ECOSYSTEMS

- Indicator 10*

- Area of forest land and net area of forest land available for timber production/
.....
- Indicator 11*
Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production.
.....
- Indicator 12*
The area and growing stock of plantations of native and exotic species.
.....
- Indicator 13*
Annual removal of wood products compared to the volume determined to be sustainable.
.....
- Indicator 14*
Annual removal of non-timber forest products (e.g. fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable.

CRITERION 3: MAINTENANCE OF FOREST ECOSYSTEM HEALTH AND VITALITY

- Indicator 15*
Area and percent of forest affected by processes or agents beyond the range of historic variation.
.....
- Indicator 16*
Area and percent of forestland subjected to levels of specific air pollutants or ultraviolet B that may cause negative impacts on the forest ecosystem.
.....
- Indicator 17*
Area and percent of forestland with diminished biological components indicative of changes in fundamental ecological processes and/or ecological continuity.

CRITERION 4: CONSERVATION OF SOIL AND WATER RESOURCES

- Indicator 18*
Area and percent of forestland with significant soil erosion.
.....
- Indicator 19*
Area and percent of forestland managed primarily for protective functions such as watersheds or flood protection.
.....
- Indicator 20*
Percent of stream kilometers in forested catchments in which stream flow and timing has significantly deviated from the historic range of variation.
.....
- Indicator 21*
Area and percent of forestland with significantly diminished soil organic matter and/or changes in other soil chemical properties.
- Indicator 22*
Area and percent of forestland with significant compaction or change in soil physical properties resulting from human activities.

.....
Indicator 23

Percent of water bodies in forest areas with significant variance of biological diversity from the historic range of variability.

.....
Indicator 24

Percent of water bodies in forest areas with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals, sedimentation, or temperature change.

.....
Indicator 25

Area and percent of forestland experiencing an accumulation of persistent toxic substances.

**CRITERION 5: MAINTENANCE OF FOREST CONTRIBUTION
TO GLOBAL CARBON CYCLES**

Indicator 26

Total forest ecosystem biomass and carbon pool and, if appropriate, by forest type, age class, and successional stages.

.....
Indicator 27

Contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon.

.....
Indicator 28

Contribution of forest products to the global carbon budget.

**CRITERION 6: MAINTENANCE AND ENHANCEMENT OF LONG
TERM MULTIPLE SOCIOECONOMIC BENEFITS TO MEET THE
NEEDS OF SOCIETY**

Indicator 29

Value and Volume of Wood and Wood Products, Including Value Added Through Downstream Processing

.....
Indicator 30

Value and Quantities of Production of Non-Wood Forest Products

.....
Indicator 31

Supply and Consumption of Wood and Wood Products

.....
Indicator 32

Value of Wood and Non-Wood Products as a Percentage of GSP

.....
Indicator 33

Degree of Recycling of Forest Products

.....
Indicator 34

Supply and Consumption/Use of Non-Wood Forest Products

.....
Indicator 35

Forest Land Managed for General Recreation and Tourism, in Relation to the Total Area of Forest Land

.....
Indicator 36

Number and Type of Facilities Available for General Recreation and Tourism

.....
Indicator 37

Visitor Days Attributed to Recreation and Tourism

.....
Indicator 38

Value of Investment in Forest Health and Management, Reforestation, Wood Processing, Recreation, and Tourism

.....
Indicator 39

Level of Expenditure on Forest Related Research and Development, and Education

.....
Indicator 40

Extension and Use of New and Improved Technology in the Forest Industry

.....
Indicator 41

Rates of Return on Investment in Forests

.....
Indicator 42

Forest Land Managed to Protect Cultural, Social, and Spiritual Needs, in Relation to the Total Area of Forest Land

.....
Indicator 43

Non-Consumptive Use Forest Values, Including Social/Cultural, Recreational, and Biological Values

.....
Indicator 44

Direct and Indirect Employment in the Forest Sector, and Forest Sector Employment as a Proportion of Total Employment

.....
Indicator 45

Average Wage Rates and Injury Rates in Major Employment Categories Within the Forest Sector

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Indicator 46

The Viability and Adaptability of Forest Dependent Communities, as They Respond to Changing Economic Conditions

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Indicator 47

Area and Percent of Forest Land Used for Subsistence Purposes

**CRITERION 7: LEGAL, INSTITUTIONAL AND ECONOMIC
FRAMEWORK FOR FOREST CONSERVATION AND
SUSTAINABLE MANAGEMENT**

Indicator 48

The Extent to Which the Legal Framework Clarifies Property Rights, Provides for Appropriate Land Tenure Arrangements, Recognizes Customary and Traditional Rights of Indigenous Peoples, and Provides Means of Resolving Property Disputes by Due Process

Indicator 49

The Extent to Which the Legal Framework Provides for Periodic Forest-Related Planning, Assessment, and Policy Review That Recognize the Range of Forest Values, Including Coordination With Relevant Sectors

Indicator 50

The Extent to Which the Legal Framework Provides Opportunities for Public Participation in Policies and Decisions Related to Forests, and Supports Public Access to Information

Indicator 51

The Extent to Which the Legal Framework Encourages

Indicator 52

The Extent to Which the Legal Framework Provides for the Management of Forests to Conserve Special Environmental, Cultural, Cultural, Social and/or Scientific Values

Indicator 53

The Extent to Which the Institutional Framework Supports the Capacity to Provide for Public Involvement Activities and Public Education, Awareness, and Extension Programs, and Make Available Forest Related Information

Indicator 54

The Extent to Which the Institutional Framework Supports the Capacity to Undertake and Implement Periodic Forest-Related Planning, Assessment, and Policy Review Process, Including Cross-Sectional Planning and Coordination

Indicator 55

The Extent to Which the Institutional Framework Includes the Capacity to Develop and Maintain Human Resource Skills Across Relevant Disciplines

Indicator 56

The Extent to Which the Institutional Framework Has the Capacity to Develop and Maintain an Efficient Physical Infrastructure, in Order to Facilitate the Supply of Forest Products and Services and Support Forest Management

Indicator 57

The Extent to Which the Institutional Framework has the Capacity to Enforce Laws, Regulations, and Guidelines

Indicator 58

The Extent to Which Investment and Taxation Policies and the Regulatory Environment Recognize the Long-Term Nature of Investments in Forests, and the Extent to Which These Policies and Regulations Permit Capital to Flow in and Out of the Forest Sector in Response to Market Signals, Non-Market Economic Valuations, and Public Policy Decisions, in Order to Meet Long-Term Demands for Forest Products and Services

Indicator 59

The Extent to Which the Economic Framework Supports Non-Discriminatory Trade Policies for Forest Products

Indicator 60

The Availability and Extent of Up-To-Date Data, Statistics, and Other Information Important to Measuring or Describing Indicators Associated With Criteria 1-7

Indicator 61

Scope, Frequency, and Statistical Reliability of Forest Inventories, Assessments, Monitoring, and Other Relevant Information

Indicator 62

Compatibility With Other Countries in Measuring, Monitoring, and Reporting on Indicators

Indicator 63

Development of the Scientific Understanding of Forest Ecosystem Characteristics and Functions

Indicator 64

Capacity to Develop Methodologies to Measure and Integrate the Environmental and Social Costs and Benefits of Forest Management Into Markets and Public Policies; and Also The Capacity to Reflect Forest-Related Resource Depletion or Replenishment in National Accounting Systems

Indicator 65

Capacity to Develop New Technologies and to Assess the Socioeconomic Consequences Associated With the Introduction of New Technologies

Indicator 66

Capacity to Enhance the Ability to Predict the Impacts of Human Intervention on Forests

Indicator 67

Capacity to Predict the Impacts of Possible Climate Change on Forests

WISCONSIN'S STATEWIDE FOREST PLAN

Wisconsin Department of Natural Resources

Division of Forestry

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